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ABSTRACT

This is a study on the operating efficiency of the public library system in Australia. Cost functions have been fitted to library data and the results are interpreted with a view to generating insights into the functioning of the existing library system. An exploratory cost benefit analysis has also been attempted. Activities of libraries have been sample surveyed with the objective of providing information for rationalization and regionalization of Australian public libraries. Policy implications and avenues for further research based on the study are presented. Appendices include an explanation of some limitations of the collected data, means and standard deviations of cost and output data for each library surveyed, copy of the survey form, and cost data for various library operations. (Author/JPF)

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Cost Analysis of Public Libraries in Australia*

by

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June, 1976

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Finally we wish to express our appreciation to Miss Margaret Cowan, Mrs. Rhonda Graham, Mrs. Donna Hooper, Miss Christine Whyte and Miss Jan Byrne for sharing the burden of typing the report at short notice.

Chapter 1
Introduction and Terms of Reference

Introduction

1.1 At present in Australia there are two conflicting trends in public library administration. On the one hand, professional librarians and community groups are pointing out deficiencies and inequalities in existing services and expressing the point of view that these facilities should be upgraded and expanded to meet the needs of the "information society". On the other hand government institutions (at local, state and federal level) responsible for funding public libraries are finding that their allocations, though constantly on the increase, are being eroded by chronic inflation in the economy to such an extent that maintenance of the existing services at their current level is difficult. This is the dilemma which besets the policy makers. To resolve the latter problem they have attempted to investigate the possibilities of providing library services more efficiently to society by rationalising existing services.

In this report an attempt is made to investigate empirically the costs of various library systems and library operations by utilising published data and by collecting information by a survey. In Chapter 2, an attempt has been made to formulate a methodology of cost analysis of public library operations in various states. Library systems operating within each state are evaluated for their performance by adapting the standard micro-economic theory of the firm. Library systems are treated as firms and their operating efficiency is determined by examining cost data. Cost functions have been fitted to available data on library operations. Despite its limitations circulation was used as a proxy measure for library output and output as a function of costs was measured. Marginal and average costs of library operation were studied using these cost functions. Some insights were gained into operating efficiency of various library services in each state. Besides, simple cost functions relating output to cost, multi-variate relationships amongst other variables that explain library operations were quantified. Relationship between circulation, holdings, membership, population, additions, staff and service points were established providing information useful for library service budgeting and programming. The results of these analyses are provided in Chapter 3.

An attempt is made in Chapter 4 to explore the prospects of quantifying the cost-benefits of public library systems operating in various states in Australia. The study merely skims the surface of the complexities involved in quantifying the benefit-costs of a public library services in monetary terms. A formula for calculating comprehensive benefit-cost ratios of library services is proposed. The formula is modified to make it operational in the context of data that was available. The application of the formula highlights the gaps in existing information (e.g. the lack of reliable non-user information) which limit a comprehensive study of public library performance. Based on limited data, an attempt has been made to rank performance of public library services in various states in terms of a modified benefit-cost formula. The results of the ranking have to be interpreted with much caution, particularly since no allowance has been made for differences in the quality of services, e.g. the efficiencies accruing from trained or professional staff to users. The benefit-cost calculations provide some objective guidelines for federal and state allocation of resources and more importantly, throw into clear relief deficiencies in existing information on the functioning of public library services that has to be made good in the interests of efficient decision making.

Chapter 5 investigates the relationship between library size and the cost of particular library operations. The main objective of the analysis was to investigate the average cost of performing individual library operations as a function of various output measures. Acquisition, cataloguing, processing, circulation, inter-library loan, reference, photocopying, and special programme costs were studied. Information on classification of book-stocktype, capital inputs, intensity of book usage were also garnered.

Chapter 6 details the implications and conclusions of the study.

A Review of Selected Sources of Literature

1.2 The cost investigations in the report were performed at a macro-level studying the average costs of individual library activities. The methodologies formulated for executing the macro and micro cost analyses are indebted to several sources as indicated in the references at the end of each chapter and the bibliography.

The main source for Chapter 4 is found in the literature on benefit-cost analysis of public utilities. Benefit-cost analysis is described as a practical method of evaluating the long and short-term performance of a public utility or project like a library system. The method of benefit-cost analysis is firmly rooted in the notions of economic rationality. In the case of its application to the evaluation of the efficiency of a public library service it may fail to quantify all relevant cost benefits due to data and conceptual difficulties. In this context Prest and Turvey, state that "even if cost-benefit analysis cannot give the right answers, it can sometimes play the purely negative role of screening projects and rejecting those answers which are obviously less promising."[1]

One of the first applications of benefit-cost analysis to library studies is the UCLA study (1966) relating to the extension of library hours.[2] The funds needed to maintain extended hours of library service and the benefits that might accrue to the University community are quantified and alternatives are explored. The first large scale application of the technique of benefit-cost analysis to evaluate alternative programmes of library resource allocation is found in the MIT study (1969).[3] Based on budgetary constraints and user preference objectives, the study examined problems relating to location, storage and purchase of materials to service research demands.

The study by Hu et al.[4] of benefit costs of bookmobiles and books by mail is the most comprehensive in this field analysis that authors of the present study perused. It also extensively reviews literature on cost-benefit analyses pertinent to the evaluation of library performance as investigated in this report. A useful review of benefit-cost studies of libraries is contained in a mimeograph by Caldwell & Lemmes.[5]

Terms of Reference and their Interpretation

1.2 The Committee of Inquiry into Public Libraries (CIPL) engaged the assistance of

1. Prest, A.R. and Turvey, R., "Cost-Benefit Analysis: A Survey" Economic Journal, December 1965, pp. 683-735.
2. "An Illustrative Cost-Benefit Analysis: Extension of UCLA Library Hours" University of California Library Association, August, 1966.
3. Raffel, J.A. and Shishko, R. Systematic Analysis of University Libraries, Cambridge, Mass., M.I.T. Press, 1969.
4. Hu, T., Booms, B.H., and Kaltreider, L.W. Benefit-cost Analysis of Alternative Library Delivery Systems, Greenwood Press, London, 1975.
5. Caldwell, M. and Lemmes, F. "A critical review of literature on cost-benefit analysis of libraries" LISM, Group Project 2, University of N.S.W. School of Librarianship, (mimeograph)

the Department of Economics at the University of Queensland to consider the following aspects of public library operations in Australia:

(1) Current operating efficiency.
(2) Economies of scale.
(3) Rationalisation prospects.
(4) The influence of technological change.

1.3 For the purposes of this study, the terms of reference were interpreted in the following way.

(1) Current operating efficiency was taken to imply the efficiency with which resources are currently being employed at current levels of service. The evaluation of efficiency in public libraries is beset by several problems: for example, the difficulty of setting operational objectives in measurable terms, and the difficulty of taking account of differences in the quality of services provided by different libraries. Nevertheless, an economist is tempted to believe that at least two measures exist which are instructive in considering efficiency. One of these is an "average" measure. This is basically the average unit cost of performance of a service, measured by the total cost involved in performing a certain function or providing a service, divided by a measure of the existing level of operation or provision of the service. The second measure is a "marginal" concept. This measures the *extra* cost involved in expanding the size of the operation or the level of service by one unit. Both types of measure are used in this study as indicators of efficiency. The relationship between them, and the ways they may be used to make inferences about efficiency are discussed in Chapter 2 of the study. Sometimes average measures of efficiency incorporate monetary valuations of the services provided, as well as of the resources used in providing them.[6] It will be appreciated that severe problems are inherent in the quantification of monetary values of services provided by public libraries. Nevertheless, this study has ventured to make a rudimentary valuation of services in monetary units or dollar terms.

(2) The term "economies of scale" has a quite specific definition in economic analysis, but for the purpose of this study it has been interpreted more widely, and will be referred to hereafter as economies of *size* rather than *scale*. Two aspects of economies of size were investigated.

(a) What happens to the cost per unit of the operation of the library as a whole as the size of the library increases?
(b) What happens to the cost per unit of performance of specific functions within the library as the size of that particular function increases?

(3) Implicit in the term "rationalisation" is the possibility of changes in the structure of library systems. For example, small independent libraries may find it desirable either to amalgamate into regional systems or to centralise particular functions so that they may be performed by larger operational units. It could be demonstrated that such centralisation is economically desirable. This term of reference was, therefore, taken as an instruction to compare the experience of regional library systems with that of libraries operating as individual units. The definition of a "regional system" is not strictly set however, and it may well be that certain nominally non-regional urban systems with several branches closely resemble regional systems.

(4) The terms of reference recognize that the adoption of technological changes will influence the future efficiency of public library operations, the comparative economies of larger library systems, and the economic feasibility of rationalising library systems. This term also implicitly recognizes that some library systems may

6. One such measure is the benefit-cost ratio.

already be reaping the benefits of technological changes recently introduced. Regrettably, time and available data did not permit the consideration of the ways in which technological change might affect budgets of public libraries. Only sketchy information was available on the recent adoption of promising technological change in some library systems, and therefore this evidence is only suggestive.

1.4 The terms of reference of the Committee include a requirement to pay particular attention to "the development of methods of evaluating the effectiveness of public libraries and library systems", and in view of this some efforts to develop a methodology for evaluating the economics of public libraries seemed justified. The approach of Chapters 2, 3 and 4 reflects these methodological concerns.

1.5 It was recognized that differences of structure between library systems may explain some of the variation in observed operating efficiency and economies of size. Thus libraries were classified according to State and by organizational type (e.g. urban regional, urban non-regional, rural regional, rural non-regional). However, libraries of the same nominal type in different States may not be strictly comparable.

1.6 The measurement of current operating efficiency was approached in two ways.

(a) The relationship between the total costs of an individual library system and the level of services provided was estimated. The measure of "level of services" used in this study was the figure for total circulation for the period under review. This is obviously an imperfect measure of the level of service, and its inadequacies are readily acknowledged. Its use is defended on the grounds of unavailability of recorded information on better alternatives. These relationships were observed for each type of library, and yielded both average and marginal measures of efficiency. Availability of appropriate data permitted only the States of New South Wales, Victoria, and Queensland to be analysed in depth. The time period studied was 1974-75.

(b) The above measures are aggregative, in that they may mask important detail about the efficiency with which individual tasks are performed within a given library system. Thus it was necessary to collect information on the costs of performing a number of individual functions within a small sample of libraries in order to suggest whether a relationship might exist between these costs and the size of that function or library. The sample chosen was too small to enable separate sub-samples for each organizational type and State to be studied. The time period chosen was again 1974-75.

The information provided by both approaches is relevant to the nature of economies of size and to the prospects of rationalisation.

Chapter 2
Methodological Aspects of Cost Analysis

2.1 The analysis of current operating efficiency falls into two sections as foreshadowed in 1.6. The methodology used for the examination of relationships between the total costs of libraries and their "levels of service" is explained. The application of this method to published data and to data supplied by local government authorities in response to a questionnaire administered by the Australian Bureau of Statistics for the CIPL in Queensland, New South Wales and Victoria is then described. An attempt to place monetary valuations on the circulation aspect of library services is also reported.

Methodological Aspects of the Cost Analysis of Australian Public Library Operations

Objectives of Public Libraries in Australia

2.2 The public library system of Australia has been "established and maintained under the authority of law, supported wholly or mainly from public funds; open for free use on equal terms to all members of the community, regardless of occupation, creed, class or race."[1] The services offered by the public library system are financed and supported by public funds or by what has been termed the "grant economy". However, with increasing demands on public funds from competing public institutions it has become imperative to demonstrate the immediate and long-term benefits that accrue to society from any specified public expenditure. "Government and public alike increasingly demand such a justification, and the main way of defending the access to funds of any particular project is to provide quantified argumentation".[2]

2.3 In the case of public library operations several hurdles have to be cleared in order to provide quantified information on the performance of library systems. Public library services are not provided in an open market system and hence there are no price signals to indicate the value of the services performed. However, most of the inputs into the public library systems, like books, equipment, staff, accommodation, are obtained from the private market and hence can be effectively costed on the basis of prevailing market prices. But the services public libraries are required to perform do not enter the market and therefore do not have market prices.

2.4 According to the Library Association of Australia public libraries should provide services to the people "to educate themselves continually, to keep abreast of progress in all fields of knowledge, to maintain freedom of expression and a constructively critical attitude towards public issues, to be better social and political citizens of their country and the world, to be more efficient in their day to day activities, to develop their creative capacities and appreciation in arts and letters, to aid generally in the advancement of knowledge, to use their leisure time to promote personal happiness and social well-being."[3] Public libraries are expected to provide services which by nature have so far defied quantification. Libraries are expected continually to educate the

1. Library Association of Australia. Interim Minimum Standards for public libraries. Sydney, 1972. p. vii.
2. Wolfe, J.N., et. al. The Economics of Technical Information Systems, Praeger, New York, 1974, p. 1.
3. op. cit., p. vii.

community; provide them with leisure or recreational reading; deepen their civic consciousness; and widen their cultural and international awareness and outlook. Moreover, the librarians have one viewpoint about what the libraries ought to provide whilst public may demand something different. Hence, there could be either "supplier oriented services" or "user oriented services" emanating from a public library system.

2.5 A simplistic way out of the conceptual maze would be to regard the main objective of public libraries as being to provide "user oriented services" or to provide books demanded by the reading public. A simple and logical quantification of this library service could be the number of books issued or circulated during a specified time period. Although the services or benefits provided by public library systems do not enter the market, there are techniques of evaluating and quantifying the services provided by public utilities, and the services of public goods in other fields.

"Standards Approach" to Quantification

2.6 A popular approach to the evaluation of the performance of the public library could be termed the "standards approach". A good example of the application of this approach is embodied in the submissions of the State Librarian of Queensland to the Commonwealth Grants Commission.[4] Although this technique is informative in comparing the relative disabilities suffered by different State library systems on the basis of socio-economic criteria or standards, it is not an adequate means of evaluating operating efficiency or the economics of public library services. The "standards approach" is based on a fixed input-output coefficient comparison: e.g. per-capita subsidies received by different States, or comparisons of book-stock per capita. It does not recognize the scarcity or competitiveness of public resources. The economic problem (i.e. the allocation of limited public resources or funds in order to provide the optimal services to public) is assumed away. The "standards approach" is deficient, since it ignores the problems associated with the current competitiveness of the "grant economy" or public funds. Further, the approach suggests that output can be estimated by measuring inputs. These defects detract from the efficacy of the "standards approach" as a technique of measuring operating efficiency of library services in Australia.

Library Cost Functions Viewed in the Context of the Micro-economic Theory of the Firm

2.7 The cost analysis of the operating efficiency of public library systems in Australia is based on traditional micro-economic theory of the firm. Library operations are assumed to be analogous to the activities of a firm.

In micro-economic analysis of the firm's costs the total cost function, which expresses a causal relationship between total cost and output, is the basic framework used.[5] Total costs comprise fixed costs and variable costs. Fixed costs are fixed only in the short-run; in the long-run all costs are variable. In the context of a library system, fixed costs refer to items such as buildings, accommodation, equipment, book-stock, etc. Variable costs refer to book additions or acquisitions, salaries, maintenance, and similar cost items that vary with output in the short-run.

4. Ryan, S.L., Submission prepared by the State Librarian of Queensland for Presentation to the Commonwealth Grants Commission, 1974 and supporting statements.
5. Henderson, J.M., Quandt, R.E., Micro-Economic Theory. A mathematical approach, McGraw-Hill, Tokyo 1971, Chapter 3. provides an excellent survey of micro-economic theory of the firm's cost functions.

In symbols,

total cost: $TC = a + f(q)$

where TC: total cost

a: fixed cost

q: output

f(q): variable cost

(i.e. total cost = fixed cost + variable cost).

Average total cost: $ATC = \frac{a + f(q)}{q}$

Average Fixed Cost: $AFC = \frac{a}{q}$.

Average Variable Cost: $AVC = \frac{f(q)}{q}$.

Marginal cost is defined as the change in total cost resulting from a unit change in output, and is obtained by differentiating the total or variable cost function with respect to output.

The first derivative is marginal cost: $MC = \frac{d(TC)}{dq} = f(q)$

The concept of marginal cost, or the incremental cost per unit of additional output, is an important tool in economic decision making. It provides a useful feed-back to management regarding production decisions.

Functional Form of the Cost-Output Relationships

2.8 The functional form of the cost-output relationship has to be specified prior to empirical investigation of cost behaviour. Here, economic theory is invoked. "In this connection, we should interpret economic theory broadly to include the results of prior empirical investigations, so that if some functional form has proved useful in earlier work in related data it should be considered again ... "[6] By reference to library studies in United States, particularly the study of Hu et al.[7] and the study of Baumol and Marcus[8] and other empirical cost studies on the theory of the firm due to Johnston,[9] the following functional forms were chosen as possible alternative approximations of the relationship between total cost and output. Let Y = total cost; X = output (circulation); β = unknown parameters; ϵ = error term.

Linear total cost function: $Y = \beta_1 + \beta_2 X + \epsilon$

Quadratic total cost function: $Y = \beta_1 + \beta_2 X + \beta_3 X^2 + \epsilon$

Cubic total cost function: $Y = \beta_1 + \beta_2 X + \beta_3 X^2 + \beta_4 X^3 + \epsilon$

Logarithmic total cost function: $Y = \alpha X^{\beta} + \epsilon$

$$\text{or} \quad \log Y = \log\alpha + \beta \log X + \log\epsilon$$

Related to the first three total cost functions we could derive corresponding average cost functions (ATC), by dividing total cost functions by output, thus:

6. Goldberger, A.S., Topics in Regression Analysis, Macmillan Co., New York, 1968, p. 127.
7. Hu, et al., op.cit.
8. Baumol, W.J., Marcus, M., Economics of Academic Libraries, American Council on Education, Washington D.C., 1973.
9. Johnston, J., Statistical Cost Analysis, McGraw-Hill, New York, 1960.

For the linear function: $ATC = \frac{\beta_1}{X} + \beta_2 + \frac{\epsilon}{X}$

For the quadratic function: $ATC = \frac{\beta_1}{X} + \beta_2 + \beta_3 X + \frac{\epsilon}{X}$

For the cubic function: $ATC = \frac{\beta_1}{X} + \beta_2 + \beta_3 X + \beta_4 X^2 + \frac{\epsilon}{X}$

For the logarithmic function: $ATC = \alpha X^{\beta-1} + \frac{\epsilon}{X}$

Conventional econometric techniques were used to test the relevance of these alternative functional forms to the cost experience of public libraries in all States.[10]

Some Theoretical Implications of the Functional Forms

2.9 The functional forms described above should be seen as alternative approximate summaries of the observed range of cost experience in the public libraries studied. The different functional forms imply different characteristics of the marginal and average costs of these libraries. These will be briefly discussed.

The simplest specification of the cost-output relationship, and the one most widely used in empirical investigations, is the linear function. The β_2 coefficient represents the marginal cost, (i.e. the increment in total cost resulting from a one unit expansion of output). This enforced constancy of marginal cost is not consistent with the usual a priori assumptions about behaviour of cost in the real world, except perhaps over a limited range of output. The behaviour of average cost for a linear function is as follows: if β_1 is positive, ATC declines throughout the range of output (see Fig. 2.1). If β_1 is negative, ATC increases throughout the range of output (see Fig. 2.2).

In this study, it is assumed that economies of size are reflected in the behaviour of ATC. Thus a linear function with β_1 positive is assumed to reflect the existence of economies of size, since average cost of the provision of service declines throughout, while a linear function with β_1 negative reflects diseconomies of size. Economies of size might arise due to the spreading of fixed costs or overheads, and due to better management and utilisation of resources invested in library operations.

Comparisons of the size of marginal cost and average cost between different samples of libraries also suggest comparative efficiency. If a particular system has a lower marginal cost than some other system, then a library in the former will incur lower increased costs in expanding its circulation than will a library in the latter. Similar comparisons between the *average* costs of libraries in different organizational structures may also be instructive.

The quadratic total cost function exhibits the shape of a parabola, and may better fit the scatter of observed data. The marginal cost exhibited by this function may be increasing or decreasing, and the average cost per unit output may both fall and rise for different ranges of output within the same sample of libraries (see Fig. 2.3).

The cubic total cost function yields average and marginal cost characteristics which are more consistent with the economist's a priori conceptualisation of cost behaviour. This is illustrated in Fig. 2.4. Again, regions of both decreasing average costs

10. The β coefficients were estimated by the technique of "ordinary least squares" (OLS), based on the classical normal linear regression model, applied to both published data and to data collected in the ABS questionnaire. If these coefficients are statistically significant, then it is implied that output does have an effect on cost. The technique also yields a value called the coefficient of multiple determination, R^2. If this value is high (near unity), then the fit is deemed to be good.

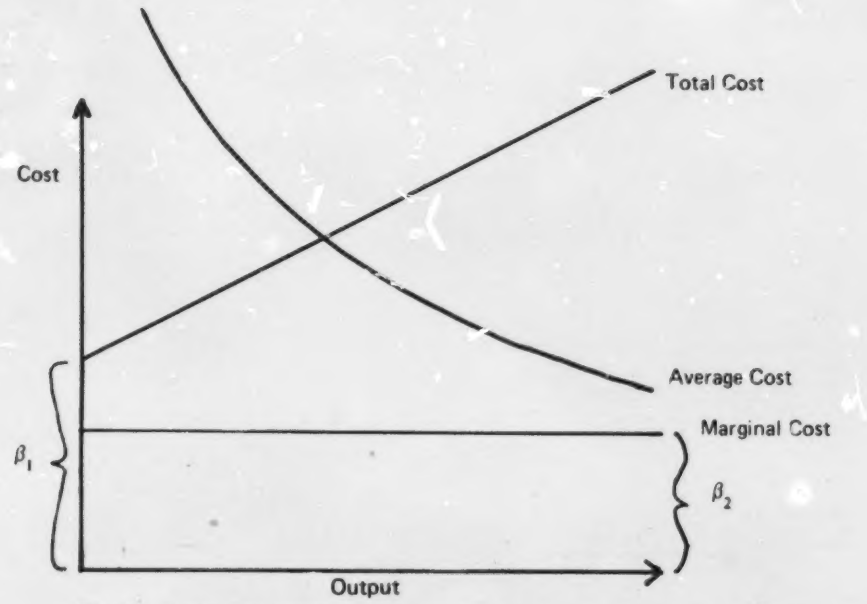

Fig. 2.1. Linear total cost function: economies of size

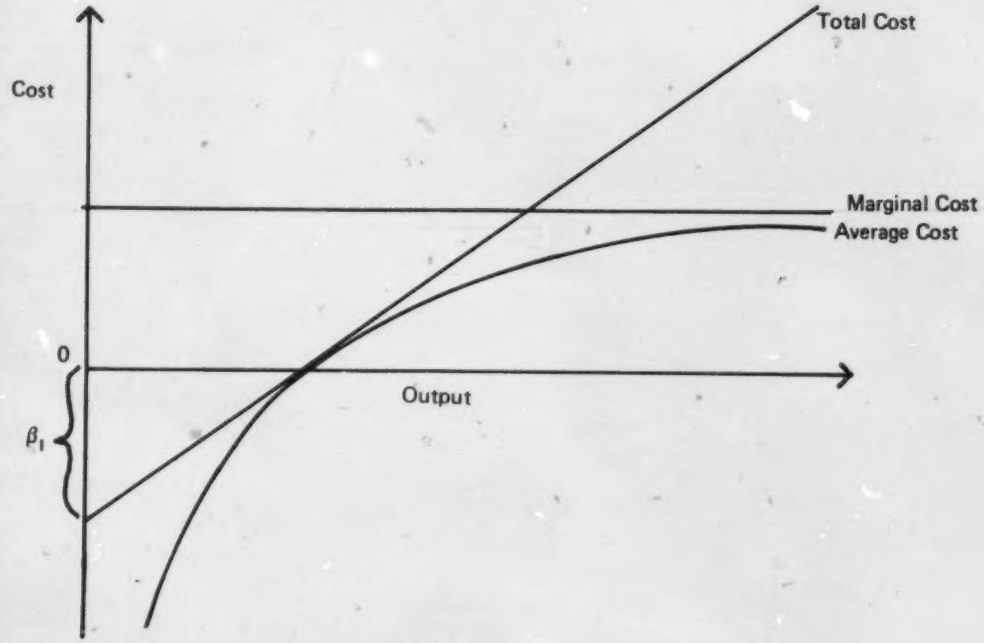

Fig. 2.2. Linear total cost function: diseconomies of size

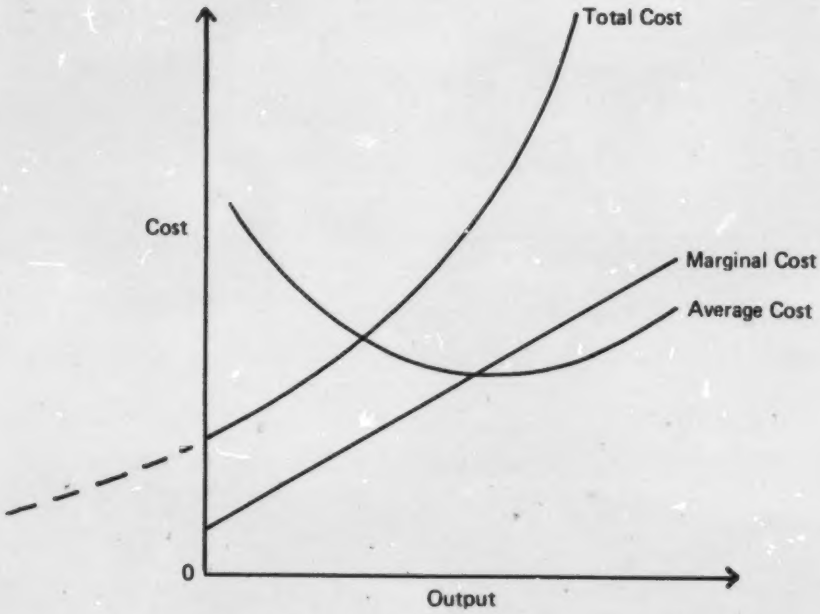

Fig. 2.3. Quadratic total cost function

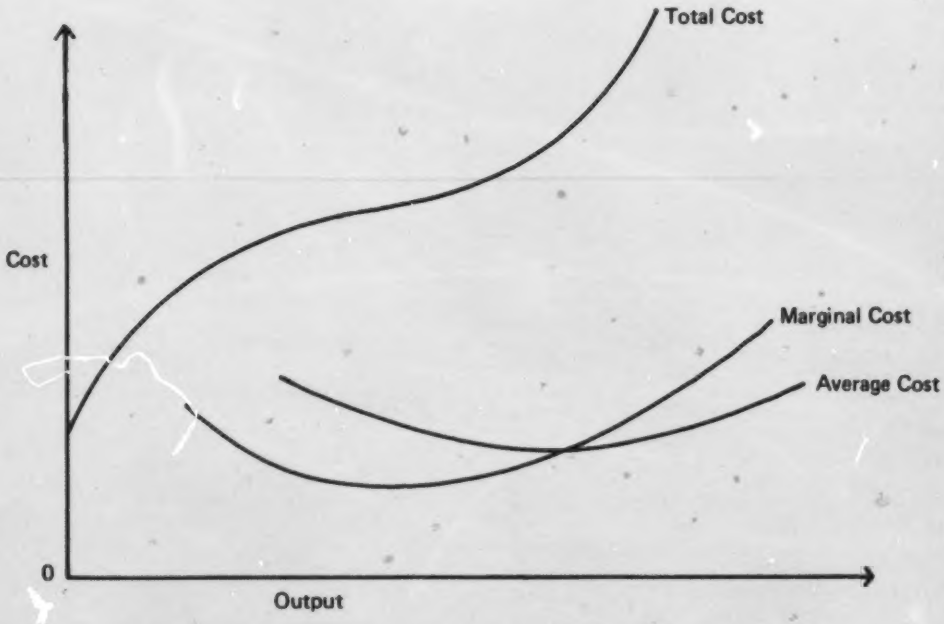

Fig. 2.4. Cubic total cost function

(economies of size) and increasing average costs (diseconomies of size) may be exhibited.

The logarithmic total cost function may exhibit either continuously decreasing average cost or continuously increasing average cost, depending on whether the estimate of β is less than or greater than unity respectively. Thus an estimate of β less than unity implies efficiency of the system in some sense, while an estimate of β greater than unity implies inefficiency (see Figs. 2.5 and 2.6).

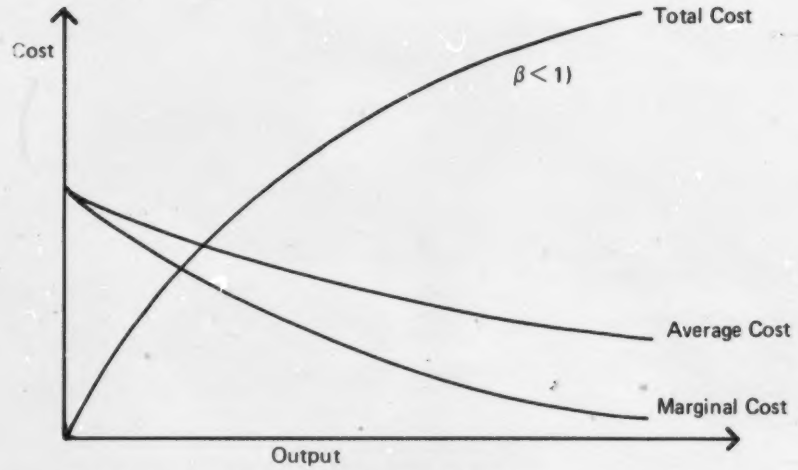

Fig. 2.5. Logarithmic function: economies of size

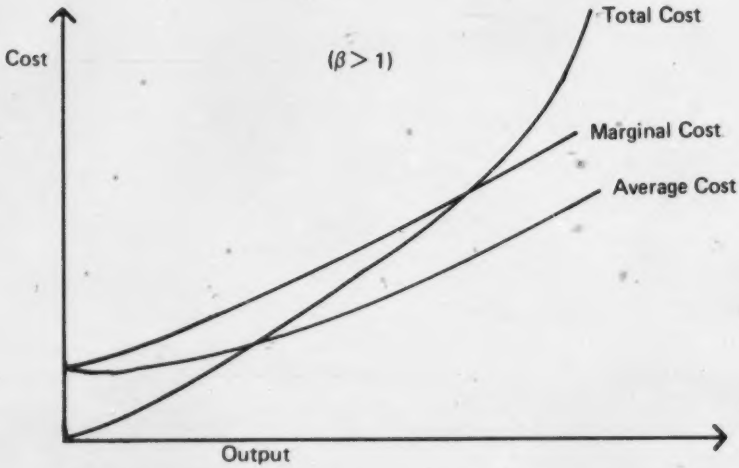

Fig. 2.6. Logarithmic function: diseconomies of size

The long-run and short-run cost functions and their significance

2.10 Already reference has been made to the distinction between short-run and long-run cost functions. In the case of long-run cost functions all inputs are variable. Library management would be free to vary the scale of library operations by varying factors like buildings, book-stock, equipment, etc. In this study, the focus of attention will be mainly on short-run cost analysis. The data on variable costs like book additions, salaries and miscellaneous expenditure like maintenance, in published records are reliable, but data on fixed costs like land and buildings, value of book-stock and total equipment are extremely difficult to obtain. Estimation of these fixed costs would involve several assumptions and imputations and further collection of data. Such an investigation is not attempted at this stage. Instead, short-run costs are analysed using cross-sectional data for all States. The short-run cost curves postulated for different library systems on the basis of cross-sectional data could theoretically be interpreted to represent long-run cost information. The minima points of the short-run average cost functions are tangential to the long-run cost function at its minimum point according to micro-economic theory.[11] The cost functions obtained from cross-sectional data, herein used for probing short-run cost relationships, could be interpreted as long-run cost functions on the assumption that the library systems are operating under equilibrium conditions or at maximum levels of efficiency in the short-run. This "cross-section approach will obviously work best in an industry subject to slow technical change."[12] Whether or not library systems in Australia satisfy this assumption sufficiently for the purposes of this model, has not been investigated.

Published data and a proxy measure of cost used in the study

2.11 The published data on expenditure of public libraries do not meet the dictates of the economist's concept of cost which is embodied in the hypothesised cost functions. The economist's concept of cost is based on the notion of opportunity cost (i.e. the value of the resource's use in the best alternative foregone by the allocation of funds to library operations). In advanced economies like Australia opportunity costs can usually be measured in terms of market prices. According to theory, if there is a situation approximating to perfect competition in the market, then cost per unit in the market is the opportunity cost. The expenditure figures of inputs are assumed to be recorded in market prices.

The published estimates of expenditure usually lump both capital and current cost items. Ideally, these should be separated. Capital costs like equipment and accommodation expenditure were removed from the total cost to obtain "current" cost only for Queensland. However, it was decided to include expenditure both on new books and on "getting them onto the shelf", as librarians in Australia view these as an important element of annual current costs.

To sum up, the proxy measure for cost in this exploratory analysis is total expenditure minus items of capital expenditure where such items were identifiable in the data available.

A proxy measure for output: Circulation

2.12 A noteworthy distinction between published data on library expenditure and the concept of costs used for efficiency analysis by economists is that, for the latter, cost is always related to an output dimension. The expenditure items recorded by libraries do not relate to output measures.

11. Nevin, E., Introduction to Micro-economics, Croom Helm, London, 1973.
12. Johnston, J., op.cit. p. 30.

The proxy variable chosen to simulate output in this analysis is circulation. Output, or X, in the cost functions postulated earlier is measured by circulation, or book issues per annum from a particular library system. There are many limitations in the use of circulation as a measure of output of library systems. Circulation statistics refer only to books checked out of the library during a specified time interval. Circulation ignores in-library reading, reference work, and multiple reading (e.g. amongst family members or friends).

The Statistical Bulletin of the State Library of Queensland recognises the limitations of circulation as a measure of library performance when it suggests that a better measure would be: "percentage of the collection in use at a particular time". However, this measure cannot be quantified on the basis of available published data. An attempt to calculate this percentage for a small sample of libraries is reported in section 5.23.

2.13 R.L. Meier[13] suggests "item use per day" as a good catch-all measure of library output or service performance. He argues that the term is completely operational and explains: "The 'item' for example, is defined as an entry in the catalogue or inventory, so situated that the effort of obtaining access to it is minimized. 'Use' is defined by the population of users when interviewed about what they did with the item when it came into their hands. 'Day' provides us with a time interval that is most free of ambiguity when asking questions." A major investigation which required the collection of primary data could incorporate such a measure of output. The present exploratory study has to be satisfied with the use of circulation as the reasonable measure of output available from published data. Circulation has been used in most empirical work on library operations as a proxy measure of output and it is a simple and unambiguous concept.

13. Meier, R.L., Efficiency criteria for operation of large libraries, Library Quarterly, Vol. 31, 1961, p. 216-233

Chapter 3
Empirical Results of Cost Analysis

3.1 Of the alternative functional forms described in 2.8 the quadratic and cubic forms gave results which were, in the main, not statistically acceptable, i.e. the pattern of the observed data did not "fit" these functional summaries.[1] Therefore, attention is limited in this report to the results of fitting the linear and logarithmic forms to the data.

The results of fitting the functional forms for average cost also yielded largely inconclusive results. Consequently, the calculation of average costs reported herein is based on a simple average, calculated by dividing the total costs of all libraries in the sample under consideration by the total circulation of those libraries.

Results for Cost Functions fitted to Data for Queensland

3.2 Libraries in this State were classified in the following way:

1. Regional libraries: Four regional groupings exist, which include a total of 26 local authorities. Separate functions were fitted to data for
   (a) individual libraries within each region,
   (b) the 26 local authorities involved in regional systems, and
   (c) the regional totals for each of the four regions.
2. "Free libraries": Both rural and urban libraries are represented in this group, numbering 47.
3. Subscription libraries: This group of five libraries excludes the large system administered by the Brisbane City Council.

The data to which the cost models were applied were taken from the Queensland statistical bulletin.[2] Since information was available on some aspects of capital expenditure, a measure of "current" operating costs was derived by subtracting the figure for capital expenditure from the total. Total costs were, however, also used in alternative estimations of the relationships, in order to facilitate comparison with other States.

The results of fitting the linear and logarithmic forms to these data are now presented.

Linear cost functions

3.3 Interpreting Table 3.1 on the basis of marginal cost figures, the regional library systems appear to be more than twice as costly as the free library system. The subscription libraries may have the lowest marginal costs but the results do not appear to be statistically significant from the small sample of data analysed. The ranking of the three systems (in descending order of marginal costs) is: Inter-regional, free, subscription. On the basis of average costs the same ranking was observed.

In the case of the sample data for regional libraries it was observed that Central-Highlands, Central-Western, and North-Western regions have significant marginal cost coefficients. The "goodness of fit" of the linear function to the observed data was

1. An example of the attempt to fit these functional forms to Queensland data only is described in 3.7
2. Public libraries in Queensland, Statistical Bulletin 1974/75.

Table 3.1. Linear cost functions based on current expenditure

$CC = \beta_1 + \beta_2 X$, where X is circulation

System	Sample Size n	Constant = β_1	MC = β_2 (t value)	R^2	F value	A.C. (increasing decreasing)
Intra-regional						
Central Highlands	5	475.323	.503* (5.223)	.90	27.28*	.539 (decreasing)
Central Western	8	1450.649	.406* (4.304)	.76	18.527*	.577 (decreasing)
North Western	8	−2125.538	.672* (13.758)	.97	189.293*	.577 (increasing)
South Western	5	1453.663	.663* (2.407)	.66	5.79*	.807 (decreasing)
Combined Regional	26	−630.533	.644* (17.808)	.93	317.075*	.595 (increasing)
Inter-regional [1]	4	34,483.103	.673 (2.003)	.99	417.64*	1.087 (decreasing)
Free	47	1,674.107	.339* (18.375)	.88	337.67*	.362 (decreasing)
Subscription	5	9,419.256	.042* (11.892)	.51	3.14	.345 (decreasing)

1 Variables in this regression are regional totals.
* 5 per cent significance level (two tailed t-test)
* 5 per cent significance level (one tailed F-test)

indicated by R^2, which was only 0.66 for South-Western region. The other regions exhibited better fits to the data analysed. Besides, the F-test for all regional fits proved to be significant at 5% level indicating the overall significance of the linear relationship.

The comparison of marginal cost coefficients with the average costs for each sample yields information about economies of size. Decreasing average costs prevail in most regions, and since the total cost functions are linear, average cost exceeds marginal cost in these regions. The exception is the North-Western region in the intra-regional analysis. The sample of all intra-regional observations also displays increasing average costs.

Logarithmic cost functions

3.4 The fitting of logarithmic total cost functions to published data broadly corroborates the above evidence concerning efficiency. The coefficient, β, of the logarithmic function is a measure of elasticity or responsiveness of cost in relation to change in circulation. The elasticity coefficients for all regional log functions are less than unity, except in the case of the South-Western regional system. All the other library systems, including the combined regional system, exhibit less than unit elasticity of costs in relation to circulation. More explicitly, this means that expansion of circulation leads to a less than proportionate expansion in costs. This warrants the inference that the particular library system analysed reveals decreasing average costs on the basis of sample data. On the basis of the elasticity coefficients the operating efficiency of the various systems under study is ranked in descending order of efficiency as follows: Subscription; Central-Western; Central-Highlands; North-Western; free library system.

The elasticity coefficients (β) for all systems except the Inter-regional are significant at the 5% level of significance (on the basis of two-tailed t-tests). Furthermore,

the coefficients of determination, R^2, are in most cases above 70%, indicating a good fit of the postulated functional form to the sample data used. The F-tests also proved significant in all cases at 5% level (one sided test). This indicates an overall significance of the log-model fitted to the data in question i.e. the logarithmic functional relationship explains the variation in total costs quite well, when evaluated statistically.

Table 3.2. Logarithmic cost functions based on current expenditure

$C.C. = \alpha X^{\beta}$ i.e. $\log CC = \log \alpha + \beta \log X$, where X is circulation

System	Sample Size n	Constant = $\log \alpha$	Coefficient = β (t value)	R^2	F value
Intra Regional					
Central Highlands	5	.783	.746* (5.294)	.90	28.02*
Central Western	8	.957	.696* (3.763)	.70	14.16*
North Western	8	.029	.906* (7.982)	.91	63.71*
South Western	5	−.972	1.200* (3.446)	.80	11.87*
Combined Regional	26	.092	.912* (11.227)	.84	126.06*
Inter regional [1]	4	2.229	.554 (1.287)	.145	1.66
Free	47	−.266	.953* (15.530)	.84	241.18*
Subscription	5	2.866	.263* (4.246)	.86	18.03*

1 Variables in this regression are regional totals.
* 5 per cent significance level

Total expenditure cost functions

3.5 Tables 3.3 and 3.4 refer to linear and log functions based on total expenditure (i.e. capital and current operating costs) for Queensland, whilst Tables 3.1 and 3.2 refer only to current operating expenditure. Tables 3.3 and 3.4 are used for comparisons with other state and system results.

Table 3.3. Linear cost functions based on total expenditure

$TC = \beta_1 + \beta_2 X$, where X is circulation

System	Sample Size	Constant = β_1	MC = β_2	R^2	F value	AC
Free	47	2624.453	.387* (19.350)	.894	378.074*	.424
Regional	4	34463.729	.691 (1.980)	.662	3.195	1.104
Subscription	5	9852.800	.042 (1.556)	.434	.191	2.303

* 5 per cent significance level

Table 3.4. Logarithmic cost functions based on total expenditure

$TC = \alpha X^{\beta}$ i.e. $\log TC = \log \alpha + \beta \log X$, where X is circulation

System	Sample Size	Constant = $\log \alpha$	Coefficient = β	R^2	F value
Free	47	−.272	.967* (14.014)	.815	198.400*
Regional	4	2.222	.557 (1.269)	.446	1.609
Subscription	5	2.881	.263* (3.603)	.812	12.947*

* 5 per cent significance level

Average Cost Functions

3.6 Further insight into the operating efficiency of library systems in Queensland could be gained by examining the average cost functions fitted to the sample data. The average cost function derived from the linear TC is a rectangular hyperbola exhibiting decreasing average costs if the intercept β_1 is positive, and if the appropriate F- and t-tests of statistical significance are satisfied. The reciprocal-circulation variable (1/X) is associated with a positive constant in these cases indicating that as circulation expands the average cost will gradually decline. This supports the hypothesis that the regional systems yield economies of size, and they have scope to expand their output further. The only exception is the South-Western region, where the coefficient of the reciprocal circulation variable, (1/X), is negative, but is not statistically significant (see Table 3.5). The free and subscription library systems also support the hypothesis of decreasing costs as output expands.

The average cost functions proved to be less satisfactory than the other functional forms fitted on the basis of the goodness of fit, as measured by R^2. The subscription libraries and the Central Highlands region exhibit fairly good fits. The fit for South-Western region is very poor, explaining the conflicting conclusions that emerge from (i) the size of the coefficients of the logarithmic function, and (ii) the comparison of marginal and average costs yielded by the linear function.

Application of the quadratic total cost function to published data for Queensland

3.7 The application of the quadratic functional form yielded largely inconclusive results, the appropriate tests of statistical significance not being satisfied (see Table 3.6). Had statistical significance tests been satisfied, it would have been possible to calculate a minimum average cost, since average cost declines and then rises for this specification. It might then be possible to interpret output which corresponds to this minimum as optimal in some sense for the system under study.

Role of Multivariate Cost Functions

3.8 Hitherto, we focussed attention on a simple cost function determining an explicit relationship between cost and output as measured by circulation. In this process we have ignored the possible effects of a series of other explanatory variables which could provide information that may be useful in explaining total costs. Multivariate regression functions fitted to data on library operations have been demonstrated to be a

Table 3.5. Average cost functions (current expenditure) derived from the linear function

$AC = \frac{\beta_1}{X} + \beta_2$, where X is circulation.

System	Sample Size n	Constant = β_2	Coefficient = β_1 (t value)	R^2	F value
Intra-Regional					
Central Highlands	5	.434	1195.800* (3.339)	.79	11.15*
Central Western	8	.442	1192.276 (1.945)	.387	3.783
North Western	8	.396	240.080* (2.815)	.57	7.92*
South Western	5	.918	−631.511 (.562)	.095	.315
Combined Regional	26	.587	174.044 (1.314)	.067	1.725
Inter-Regional[1]	4	−.310	6198.532 (.141)	.50	1.984
Free	47	.230	2215.652* (5.814)	.43	33.80*
Subscription	5	.124	2067.392* (4.585)	.28	231.396*

1 Variables in this regression are regional totals.
* 5 per cent significance level

Table 3.6. Average cost functions based on current expenditure (derived from quadratic cost functions)

A.C. $= \frac{\beta_1}{X} + \beta_2 + \beta_3 X$, where X is circulation

System	Sample Size n	Constant = β_2	Coefficient = β_1 (t value)	Coefficient = β_3 (t value)	R^2	F value
Intra-Region						
Central Highlands	5	.088	1965.00132* (3.061)	.00002 (2.000)	.89	8.173*
Central	8	.498	1080.69228 (.93489)	−.00000	.39	1.588
North Western	8	.281	304.97081* (3.877)	.00000	.75	7.549*
South Western	5	1.231	1107.792 (.543)	−.00002 (.333)		
Combined Regional	26	.587	174.04366 (1.314)	.00000	.07	1.725
Inter-Regional	4	−5.358	291,681.847* (22.143)	.00003	.998	325.678*
Free	47	1.716	2389.15726* (5.976)	.00000	.45	18.074*
Subscription	5	.206	2186.863* (4.551)	.00000	.996	232.766*

* 5 per cent significance level

useful technique for long-term budgetary planning of academic libraries in the United States[3].

The regression coefficients calculated for the data of various library systems enable illuminating comparisons to be made. In addition to the effects of increased circulation, the technique allows us to evaluate the incremental cost of each additional volume, staff member, service point, etc. We can also study the way in which certain socio-demographic variables like population are related to library costs. It would be informative from a planning and management point of view to learn if different library systems within a state have different quantitative influences on their holdings, acquisitions, staff, circulation etc. These results could be compared with similar studies that could be executed for other States in Australia.

Application of multivariate functions to data for Queensland

3.9 Based on the Queensland data a multivariate function was used to investigate the relationship between cost and eight explanatory variables for the 47 observations of free libraries in Queensland.

The explanatory variables regressed on costs were:

circulation, holdings, registered members, population, additions, full-time staff, part-time staff and number of service points. The cost function postulated here explains the variation in costs through these independent (or control) variables.

The time period considered is one year, 1974-75.

In Table 3.7 the equation for free libraries indicates that a unit increase in population accounts for $0.19 variation in cost, on the average. Further, a unit increase in additions is associated with a $1.67 increase in costs. A unit variation in full-time staff led to $6,464.97 variation in costs. Only those coefficients that are significant at 5% level for a two-tailed t-test have been interpreted. The size of R^2 indicates that the fit is a very good one, 99% of the variation in costs being explained by the variables included in the model. The F-test is also significant indicating the overall significance of the relationship fitted.

The results obtained from fitting the function to the data for 47 free libraries may be compared with the results for the whole of Queensland, based on 56 observations. The acquisition or addition costs for all libraries were much higher than for the free libraries alone. There was a difference of 49 cents. The marginal cost of an extra staff member was less for all libraries than for the free library system, indicating that the full-time staff commanded on the average $907.81 more per annum per full time employee in the latter. This may be the result of relatively more professional librarians in the free local authority library system compared to the whole library system.

The relationship between cost and other explanatory variables for the whole of Queensland indicates that additions and full-time staff salaries are the two significant explanatory variables in cost-output relationship. An addition of one book leads to an increment of $2.16 in costs and the addition of one full-time staffer leads to an increment in cost of $5,557.16 for the sample of all libraries.

3.10 Besides analysing the relationship between cost and the list of explanatory variables mentioned above, an investigation was made of the inter-relationship between those variables in 47 free libraries in Queensland (see Table 3.8). The multivariate relationships were fitted to published data for 1974-75. The asterisk indicates the significance of the two-tailed t-test and one the tailed F-test at 5% level for the data analysed.

3. Baumol, W.J. and Marcus, M., op.cit.

Table 3.7. Multivariate Cost Functions for Queensland

System	Sample Size n	Constant	Circulation (t value)	Holdings (t value)	Membership (t value)	Population (t value)	Additions (t value)	Staff Full-time (t value)	Staff Part-time (t value)	Service Points (t value)	R^2	F value
QLD	56	−6563.94		.04	1.83		2.16*	5557.16*		4241.58*	.953	138.65*
				(.154)	(2.05)		(2.94)	(4.92)		(2.43)		
FREE	47	549.22	.09*	−.22	.58	.19*	1.67*	6464.97*	2138.39	−1865.80	.986	240.04*
			(3.00)	(1.1)	(.52)	(5.43)	(2.46)	(7.78)	(1.57)	(1.23)		

* 5 per cent significance level

Table 3.8. Multivariate Relationships on the Operation of Free Library System of Queensland (n = 47)

	Current Expenditure	Constant	Circulation (t value)	Holdings (t value)	Additions (t value)	Membership (t value)	Population (t value)	Staff Full-time (t value)	Staff Part-time (t value)	Service Points (t value)	R^2	F value
		549.97	.09*	−.22	1.67*	.58	.19	6464.97*	2138.39	−1865.80	.981	240.043*
			(3.00)	(−1.1)	(2.46)	(0.52)	(.543)	(7.78)	(1.57)	(1.23)		
Circulation	1.64*	−8542.97	–	.92	−10.31*	−6.30	4.71*	5827.98	−14814.33*	6324.81*	.951	92.921*
	(2.48)			(1.03)	(3.21)	(−1.30)	(3.60)	(0.02)	(2.61)	(5.85)		
Holdings	−.14	2183.30	.03	–	.15	2.13*		2585.93*	−171.70		.951	107.078*
	(−1.17)		(1.5)		(.33)	(4.18)		(2.83)	(−.16)			
Additions	.06*	−54.77	−.02*	−.01	–	.64*	.29*	48.69	−167.81	217.37	.853	25.556*
	(2.13)		(−3.22)	(−.25)		(3.27)	(6.03)	(.19)	(.61)	(.75)		
Membership	.01	120.36	−.01	.07*	−.34*	–	.22*	189.88	−136.49	93.81	.978	212.283*
	(.25)		(1.30)	(2.54)	(3.27)		(6.29)	(1.00)	(−.68)	(.42)		
Population	.04	153.91	.05*		1.66*	2.33*	–	−1086.65	416.88	−359.08	.982	311.079*
	(0.57)		(3.71)		(6.11)	(7.70)		(02.01)	(.65)	(.56)		
Staff Full-time	.0009*	−.235		.0006*	.00002	.00013	−.00007	–	−.100	.029	.972	160.050*
	(9.00)			(3.00)	(.2)	(1.00)	(−1.75)		(−.59)	(.15)		
Staff Part-time	.00003	.072			.00006	−.0009	.0003	−.092	–	.980	.814	20.840*
	(1.5)				(.66)	(−.69)	(.75)	(−.59)		(11.97)		
Service	−.00002	.250		.0001	.00006	.00005	−.00002	.021	.806*	–	.806	19.828*
	(−1.00)			(.50)	(.66)	(.42)	(−.50)	(.15)	(11.97)			

* 5 per cent significance level

Each variable in the collection was regressed on the remaining variables. The variables in the list were: expenditure, circulation, holdings, additions, membership, population, full-time staff, part-time staff, and service points.

The independent variable is denoted on the left-hand column of the Table and the regressors or explanatory variables are described on the top-row headings, of Table 3.8.

3.11 It is demonstrated that for the free-library system, variation in circulation is explained by variations in additions, population, part-time staff, current expenditure, and the number of service points. The relationship postulates that a dollar increase in current expenditure is associated with a 1.64 increment in number of books circulated. Further, it is shown that a unit increase in population would lead to a rise in circulation by 4.71; an addition of one service point would enhance circulation by approximately 6324 books per annum. The signs of the coefficients for additions and part-time staff do not appear to conform to the a priori belief that additions and recruitment of staff lead to an increase in circulation. A possible explanation of this negative effect is that in 1974/75 volumes that do not increase circulation (e.g. encyclopaedias, reference materials) may have comprised much of the new material. The high value of R^2 indicates that approximately 95% of the variation in circulation is explained by the explanatory variables incorporated in the model. However, the fact that the variables like holdings, membership and full time staff do not yield significant t-values, while the F-test for the whole relationship is significant, is evidence of multicollinearity[4] amongst some of the explanatory variables in the postulated regression relationship.

3.12 Holdings are shown to be significantly explained by membership and full-time staff. It is shown by the relationship that an increment of one member is associated with an increase of 2.13 in holdings, and an increment of one full-time staff member is associated with an increase in holdings of 2585. The overall relationship as postulated by the explanatory variables included in the model is significant on the basis of an F-test at 5%.

The fact that the F-test is significant and the t-tests on some explanatory variables are not significant at 5% level again leads us to suspect multi-collinearity in the data. The value of R^2 was 95% indicating that the regression function fitted explained most of the variation in the holdings on the basis of explanatory variables included in the model.

3.13 Additions are shown to be explained significantly by variables such as current expenditure, circulation, membership, and population. The relationship suggests that a one dollar increment in expenditure would lead to a .06 expansion in additions; a unit increase in membership expands additions by .64 books; and a population increase by one unit would lead to an expansion of additions by .29 books. However, it is noteworthy that additions decrease by .02 with every unit increase in circulation. Perhaps new libraries with large additions to their bookstock do not as yet experience circulation commensurate with their size. The explanatory variables incorporated in the model explain 85% of the variation in additions (R^2 is .85).

3.14 Membership variation is explained by holdings, additions, and population. The relationship implies that a unit increment in book holdings is associated with an increase of .07 in membership. A unit increase in population would lead to 0.22 increment in membership. The relationship fitted indicates that membership is negatively

4. Multicollinearity occurs where two explanatory variables are correlated with each other, as well as with the dependent variable, thus making it difficult to isolate the separate effects of each explanatory variable on the latter.

related to books added, which is contrary to the a priori relationship between additions and membership, but is again consistent with the "infant library" hypothesis. The value of R^2 is .97 indicating that the model fits the data quite well. The F-test is also significant.

3.15 Population is significantly related to circulation, additions and membership. The variables are significant at 5% level. However, it would be ridiculous to interpret a causal relationship between population and the explanatory variables as the hypothesis that variation in population is caused by variation in the explanatory variables is meaningless, in the context of library operations. Nevertheless the interrelationships revealed are illuminating.

3.16 The variation in full-time staff is explained by holdings, and this is the only significant explanatory variable. The variation in service points is explained only by part-time staff which emerges as the only significant variable. In both these relationships F-test is significant at 5% level and there appears to be multi-collinearity amongst the explanatory variables incorporated in the model.

3.17 In most of the functional relationships fitted to the data there is a constant term. This constant term can usually be interpreted as the value of the dependent variable that would prevail regardless of the magnitudes assumed by the independent or explanatory variables. For example, the expenditure constant of $549.2 would be the level of expenditure that has to be incurred annually irrespective of whether there are circulation, additions, staff salaries, etc. Similarly, the holding constant of 2183.30 would be the average book holdings in the free library system irrespective of the values assumed by the other variables in the linear functional fit. In this particular example however, this interpretation of the constant term is of dubious validity.

3.18 In conclusion, the positing of functional relationships between library variables other than cost or expenditure uncovers additional useful information on the functioning of alternative library systems within a given state and between states. In this study we have illustrated the nature of such relationships derived for the free library system of Queensland. The magnitudes of the regression coefficients for the free library system and the comparisons between the free library system of Queensland and the total library system of Queensland might be evidence of their relative efficiency. Applications of the model to data for other States might be similarly suggestive. The relationships derived by considering the regression of non-cost variables on other explanatory variables throws up information that will be useful for management and objective decision-making regarding library planning and Federal and State funding for future development.

Results of cost analysis for other states

New South Wales

3.19 Libraries in this State are classified as follows:

1. Metropolitan—independent
2. Country—independent
3. Regional—country only
4. Joint—metropolitan and country.

The data were derived from tables in the Library Council of New South Wales Annual Report.[5]

The technical interpretation of these results summarised in Tables 3.9 and 3.10 is along the lines of that carried out on the results for Queensland.

Victoria

3.20 Libraries in this state are classified as follows:

1. Urban regional
2. Urban non-regional
3. Rural regional
4. Rural non-regional.

The data source was the tabulation of returns from the ABS questionnaire.

The technical interpretation of these results summarised in Tables 3.11 and 3.12 is similar to that for Queensland.

Classification of State Library Systems

3.21 The composition of the library system in each state used in this analysis is as follows:

1. Queensland—47 free, 4 regional, 5 subscription services
2. New South Wales—28 metropolitan, 43 country, 13 regional, 18 joint services
3. Victoria—5 urban regional, 16 urban non-regional, 11 rural regional, 7 rural non-regional services
4. South Australia—14 urban/rural services
5. Western Australia—17 rural, 57 urban services
6. Tasmania—35 urban/rural services.

The data source for the South Australia, Western Australia and Tasmania information was the tabulation of returns from the ABS questionnaire. The data sources for the other states have been referred to above.

Whilst it was recognized that the aggregation of data into one state figure from systems which are separate entities was an over-simplification, it was felt that such an aggregation would at least provide a quantitative comparison of the difference of marginal, average, and total costs between states.

The technical interpretation of the results as presented in Tables 3.13 to 3.20 is as before.

5. Report of the Library Council of New South Wales (1974/75).

Table 3.9. New South Wales

Linear Cost Functions

T.C. = $\beta_1 + \beta_2 X$, where X is circulation.

System	Sample Size n	Constant = β_1	Marginal Cost = β_2 (t value)	R^2	F value	Average Cost
Metropolitan	28	105,240.441	.430* (5.059)	.498	25.835*	.646
Country	43	9,934.509	.346* (21.625)	.921	475.319*	.412
Regional	13	16,180.534	.402* (6.484)	.792	41.766*	.485
Joint	18	−2,705.64	.568* (21.037)	.966	455.958*	.557

* 5 per cent significance level

Table 3.10. New South Wales

Logarithmic Cost Functions

T.C. = αX^{β} i.e. log T.C. = log α + β log. X where X is circulation

System	Sample Size n	Constant = log α	Coefficient = β (t value)	R^2	F value
Metropolitan	28	.571	.865* (8.564)	.737	72.806*
Country	43	−.053	.937* (18.373)	.891	333.896*
Regional	13	−.232	.983* (6.681)	.802	44.686*
Joint	18	−.505	1.037* (9.692)	.854	93.517*

* 5 per cent significance level

Table 3.11. Victoria

Linear Cost Functions

T. C. = $\beta_1 + \beta_2 X$, where X is circulation

System	Sample Size n	Constant = β_1	M.C. = β_2 (t value)	R^2 (F value)	F value	A.C.
Urban Regional	5	190,920.149	.454* (2.967)	.745	8.772*	.670
Urban Non Regional	16	65,932.810	.476* (6.432)	.747	41.384*	.719
Rural Regional	11	31,643.713	.321* (6.420)	.819	40.643*	.486
Rural Non Regional	7	1,838.783	.614* (3.070)	.655	9.474*	.658

* 5 per cent significance level

Table 3.12. Victoria

Logarithmic cost functions

T.C. = αX^{β} i.e. log T.C. = log α + β log X, where X is circulation

System	Sample Size N	Constant = log α	Coefficient = β (t value)	R^2	F value
Urban Regional	5	2.006	.633* (2.285)	.635	5.220*
Urban Non Regional	16	.865	.815 (6.966)	.776	48.625*
Rural Regional	11	.853	.783* (9.212)	.904	84.954*
Rural Non Regional	7	−1.417	1.257* (3.482)	.709	12.158*

* 5 per cent significance level

Table 3.13. All states

Linear cost functions

T.C. = $\beta_1 + \beta_2 X$, where X is circulation

State	Sample Size n	Constant = β_1	M.C. = β_2 (t value)	R^2	F value	A.C.
Queensland	56	4,633.185	.383* (13.207)	.764	175.024*	.461
New South Wales	102	22,759.692	.475* (17.593)	.756	309.901*	.560
Victoria	39	15,376.351	.600* (17.647)	.896	319.231*	.654
South Australia	14	2,693.000	.280* (14.350)	.945	206.060*	.300
Western Australia	74	−1,155.794	.461* (38.417)	.955	1534.398*	.439
Tasmania	35	4,194.678	.087* (6.435)	.557	41.414*	.130

* 5 per cent significance level

Table 3.14. All states

Logarithmic cost functions

T.C. = αX^{β} i.e. log T.C. = log α + β log X, where X is circulation

State	Sample Size n	Constant = log α	Coefficient = β (t value)	R^2	F value
Queensland	56	−.156	.948* (13.352)	.764	174.769*
New South Wales	102	−.536	1.047* (31.727)	.910	1012.380*
Victoria	39	−.261	1.013* (18.759)	.905	353.660*
South Australia	14	−.412	.978* (11.700)	.919	136.888*
Western Australia	74	−.225	.962* (16.586)	.793	275.070*
Tasmania	35	−.610	.945* (14.708)	.868	216.302*

* 5 per cent significance level

Table 3.15. Inter System Comparisons

Linear cost functions for metropolitan urban systems

T.C. = $\beta_1 + \beta_2 X$, where X is circulation

System	Sample Size n	Constant = β_1	Marginal cost β_2 (t value)	R^2	F value	Average Cost
Metropolitan/Urban						
N.S.W.	28	105,240.441	.430* (5.059)	.498	25.835*	.646
Victoria Non Regional	16	65,932.810	.476* (6.432)	.747	41.384*	.719
Victoria Regional	5	190,920.149	.454* (2.967)	.745	8.772*	.670
West Australia	17	−17,372.270	.501* (17.276)	.954	307.995*	.420

* 5 per cent significance level

Table 3.16. Logarithmic cost functions for metropolitan/urban systems

T.C. = αX^{β} i.e. log TC = log α + β log X, where X is circulation

System	Sample Size n	Constant = log α	Coefficient = β (t value)	R^2	F value
Metropolitan Urban					
N.S.W.	28	.571	.865* (8.564)	.737	72.806*
Victoria Non Regional	16	.865	.815* (6.966)	.776	48.625*
Victoria Regional	5	2.006	.633* (2.285)	.635	5.220*
Western Australia	17	−1.250	1.155* (10.132)	.873	103.103*

* 5 per cent significance level

Table 3.17 Linear cost functions for country/rural systems

T.C. = $\beta_1 + \beta_2 X$, where X is circulation

System	Sample Size n	Constant = β_1	Marginal cost = β_2 (t value)	R^2 (F value)	Average Cost
Country/Rural					
N.S.W. Non Regional	43	9934.509	.346* (21.625)	.921* (475.319)	.412
N.S.W. Regional	13	16180.534	.402* (6.484)	.792* (41.766)	.485
N.S.W. Joint[1]	18	−2705.64	.568* (21.037)	.966* (455.958)	.544
Vic. Non Regional	7	1838.783	.614* (3.070)	.655* (9.474)	.658
Vic. Regional	11	31643.713	.321* (6.420)	.819* (40.643)	.486
Qld. Free	47	2624.453	.387* (19.350)	.894* (378.074)	.424
Qld. Regional	4	34463.713	.691 (1.980)	.662 (3.915)	1.104
W.A.	57	1005.205	.477* (4.867)	.300 (23.538)	.635

1 Included 3 metropolitan joint library services.

* 5 per cent significance level

Table 3.18. Logarithmic cost functions for country/rural systems

T.C. = αX^{β} i.e. log T.C. = log α + β log X, where X is circulation

System	Sample Size n	Constant = log α	Coefficient = β (t value)	R^2	F value
Country/Rural					
N.S.W. Non Regional	43	−.053	.937* (18.373)	.891	333.896*
N.S.W. Regional	13	−.232	.983* (6.681)	.802	44.686*
N.S.W. Joint[1]	18	−.505	1.037* (9.692)	.854	93.517*
Vic. Non Regional	7	−1.417	1.257* (3.482)	.709	5.220*
Vic. Regional	11	.853	.783* (9.212)	.904	84.954*
Qld. Free	47	−.272	.967* (14.014)	.815	198.400*
Qld. Reg.	4	2.222	.557 (1.269)	.446	1.609
W.A.	57	−.308	.986* (6.573)	.439	43.053*

1 Inciuded 3 metropolitan joint library services.
* 5 per cent significance level

Table 3.19. Linear cost functions for regional systems

T.C. = $\beta_1 + \beta_2$ X, where X is circulation.

System	Sample Size n	Constant = β_1	Marginal cost = β_2 (t value)	R_2	F value	Average Cost
Regional						
N.S.W.	13	16,180.534	.402* (6.484)	.792	41.766*	.485
Vic. Urban	5	190,920.149	.454* (2.967)	.745	8.772*	.670
Vic. Rural	11	31,463.713	.321* (6.420)	.891	40.643*	.486
Qld.	4	34,463.713	.691 (1.980	.662	3.915	1.104

* 5 per cent significance level

Table 3.20. Logarithmic cost functions for regional systems

T.C. = αX^{β} i.e. log T.C. = log α + β log X, where X is circulation

System	Sample Size n	Constant = log α	Coefficient = β (t value)	R^2	F value
Regional					
N.S.W.	13	−.232	.983* (6.681)	.802	44.686*
Vic. Urban	5	2.006	.633* (2.285)	.635	5.220*
Vic. Rural	11	.853	.783* (9.212)	.904	84.954*
Qld.	4	2.222	.557 (1.269)	.446	1.609

* 5 per cent significance level

Chapter 4
Benefit-Cost Analysis of Public Library Services

Application of Benefit-cost Analysis to Public Services and Libraries Evaluation

4.1 The technique of benefit-cost analysis has been widely applied to the evaluation of operating efficiency of public services in various non-market operations, e.g. education, water resources, public transport, electricity, health services, urban development programmes, family planning programmes, etc. In recent years, particularly in the United States, variants of benefit-cost analysis, such as cost-effectiveness studies and programme budgeting have been applied for evaluating performance of both academic and public libraries. Raffel and Shishko[1] have used systems analysis to probe the cost-benefits of the M.I.T. library. Pfister and Milliman[2] elucidate the rationale of using cost-benefit techniques for the analysis of public libraries with several applications, mainly on the cost side. Newhouse and Alexander[3] in their study on the Beverley Hills Public library dwell on the application of benefit-cost analysis for library performance studies. The methodology of benefit quantification in this study is particularly illuminating for the prospect of possible application to Australian data. The study of Hu, Booms and Kaltreider[4] on book-mobiles and books by mail is a clear exposition of the practicability of benefit-cost techniques in the appraisal of alternative library service systems. The latter study is a most instructive reference for the application of benefit-cost analysis to Australian published data undertaken in the present study. Another good review of this area is Flowerdew and Whitehead's study.[5]

4.2 In the context of, on the one hand, growing need to work within shrinking real public expenditure constraints and, on the other, the imperative need to infuse more funds to overcome the imbalance in the standards of public library services and the demand to improve and maintain these services, the need for an operational technique grounded in sound economic theory cannot be gainsaid. The principles of benefit-cost analysis provide an answer to this need if the recommendations of the Library Association of Australia are to be implemented in the cautionary spirit in which they are made: "There should be an immediate infusion of federal aid to overcome the worst of existing inadequacies and inequalities of Australia's public library and information services, but care should be taken to ensure that short-term aid does not consolidate a foundation unfit for the future."[6] The efficient allocation of scarce public resources by the technique advocated meets the needs of this recommendation in an objective manner, provided the statistical data required for the implementation of the technique are available.

1. Raffel, J.A., Shishko, R., Systematic Analysis of University Libraries, Cambridge, Mass. The M.I.T. Press, 1969.
2. Pfister, R.L., and Milliman, J.W., op. cit.
3. Newhouse, J.P. and Alexander, A.J., An Economic Analysis of Public Library Services, Lexington, Mass: D.C. Heath & Co., 1972.
4. Hu, et al, op. cit.
5. Flowerdew, A.D.J. and Whitehead, C.M.E., Cost-effectiveness and cost/benefit analysis in information Science. London School of Economics, Oct. 1974 (Osti report s 206).
6. Library Association of Australia. Submission to the Committee of Inquiry into Public Libraries: It's all a matter of what you know, June 1975, p. 16.

4.3 In a nut-shell, if the costs and benefits of a library operation or library system under study can be rendered in monetary terms, resolving all the thorny problems of imputing values to intangible inputs and outputs, then we could arrive at a measurable benefit-cost criterion. The criterion would be a simple ratio: B/C, where B denotes benefits and C denotes the cost in monetary terms. The larger the ratio the more efficient or attractive would the service or operation under study appear to be. However, the above ratio abstracts from the time effects of the cost and benefit flows. A methodological refinement which incorporates the time factor is the well known "discounted cash flow" technique. The cash flows are discounted over time to compute a net present value of benefits as a ratio of the public funds invested in the operation. Alternatively, we could compute the internal rate of return or the marginal efficiency of capital [a la Keynes] from the cost and benefit streams. To sum up, three criteria could be computed to judge the efficiency of public funds disbursed on a library operation or system. They are: (i) benefit-cost ratio, (ii) the net present value and (iii) the internal rate of return. In this study data constraints compel us to use a benefit-cost ratio bereft of temporal considerations.

The Uses of Benefit-cost Analysis of Library Services

4.4 The main contribution of the benefit-cost ratios computed would be to assess the magnitude of social benefit generated per dollar expenditure of public funds in library services. In other words, it is a measure of economic efficiency in the context of public welfare. Besides the measurement of operating efficiency via benefit-cost analysis, this ratio would provide guidelines to librarians and policy makers in order to arrive at rational management decisions regarding library administration and development. Furthermore, these benefit-cost calculations could provide information for long-term planning and budgetary programming of various library programmes and systems. Moreover, the periodic evaluation of library services using benefit-cost techniques fulfills an important need of accountability of public funds. The public is made aware of the shortcomings or contributions made in the short-term and long-run of the disbursement of their tax-dollars to public libraries.

Monetary Valuation of Benefits Generated by Public Library Services

4.5 The concept of "opportunity costs", or the value of the best alternative that has to be sacrificed by the library users to enjoy the library services, could be used to measure its value. The assumption that the library serves a homogeneous neighbourhood underlies the dollar or monetary valuation of library services. Income distribution problems, and the existence of socially handicapped and under-privileged are ignored initially. A dollar spent by a rich person may not have the same value as a dollar spent by a poor person. Nevertheless, we assume away the existence of these problems in attempting to quantify the value of library services.

4.6 Several alternative procedures could be employed to impute monetary values to library services: (1) The library user's or consumer's willingness to pay for the services of providing books could be measured in money terms. (2) The monetary value of time saved by the existence of library services in the locality could be measured in terms of hourly earnings or wages of various categories of borrowers. (3) The average value of rent chargeable if the library operated as a commercial establishment could be a monetary measure of the value of its services. (4) Finally, the amount of money

the library users saved as a result of the existence of library facilities could be used to quantify the value of services generated by a particular library system.

4.7 In the context of available published data for Australia, the measure described in (4) was the best out of the alternative valuation procedures proposed above. The only reliable surrogate variable available to quantify benefits of alternative library systems operating in different states in Australia was circulation. We recognise that the use of circulation alone to impute monetary values to library services ignores the quality of services. The benefit measure that has been attempted herein is therefore only a "bare-bones" attempt at quantification of benefits. To the extent circulation ignores the other aspects of library services such as reference, audio-visual, children's and socially handicapped services, and efficient information provision factors, the quantification of benefits is deficient.

The Benefit-Cost Ratio for Comparing Library Systems

4.8 Conceptually, a benefit-cost ratio for the comparison of the performance of different library systems could be defined as follows:

$$\text{Benefit-Cost Ratio: } \frac{B}{C} = \frac{\sum_i \sum_t Q_{it} P_{it} b_{it} \frac{1}{(1+r)^t}}{\sum_i \sum_t E_{it} \frac{1}{(1+r)^t}}$$

- i : i-th system
- t : t-th time period
- Q_{it} : annual circulation of the i-th library system for the t-th year.
- P_{it} : average price per book circulated by the i-th library in the t-th year.
- b_{it} : users valuation of benefits generated by a book borrowed as a fraction of the average purchase price, $0 \leqslant b_{it} \leqslant 1$
- r : the discount rate or society's time preference for library services at present vis-a-vis the future.
- E_{it} : expenditure (capital and operating) incurred by the i-th library in the t-th year.

The Parameters of the Benefit-Cost Ratios

4.9 The only satisfactory variable reported in annual reports and the ABS questionnaire for a comparison of benefits of library systems was circulation. Any benefit calculations therefore suffer from the limitations imposed by the paucity of existing data. To measure the benefits generated by circulation it had to be evaluated by a suitable monetary measure. We have assumed that the purchase price of various categories of books would reflect the utility or worth of the book to the purchaser and a library borrower would at most get satisfaction equivalent to the market price of the book borrowed.

4.10 The average price for purchasing various categories of books in Queensland was $4.64.[7] This price was used to evaluate the maximum benefits that could be attributed to borrowers of books from public library systems.

4.11 To assume that every borrower derived satisfaction from a book equivalent to

7. Ryan, S.L., State Librarian of Queensland. Additional Statement prepared for the Commonwealth Grants Commission, Queensland Hearing, December 1974, p. 3.

the ownership of the book as reflected in the purchase price may overstate benefits. On the basis of data available for two American rental libraries (The New York State Library and Hunter's Rental Library in Beverly Hills) a Rand Corporation study[8] suggests that 10% of the purchase price of a book could be the marginal borrower's willingness to pay for borrowing a book. This marginal borrower's willingness to pay could be used to measure the satisfaction derived by a user who borrows a book from a public library. Hence, the b-coefficient or the satisfaction derived by borrowing a book from a public library expressed as a fraction of the purchase price has been assumed to be 0.1 or 10% of the purchase price in the computations of benefits.

4.12 Although we could form reasonable estimates about the social discount rate or the society's willingness to pay for the library services now rather than in the distant future, in the absence of time profiles of future benefits the problem of discounting over time could not be tackled at this stage.

4.13 In discounting benefit and cost streams over time we would use a relatively high discount rate as we consider that for public libraries circulation now and in the near future is more valuable than circulation in the distant future. This would also imply that fiction and children's literature in public libraries would assume greater significance than non-fiction since the former categories of books may have a higher circulation in the current years. The life span of various types of books also could be estimated from available data. The average life-span of a public library book has been put at about 8 years.[9] The non-availability of information of benefit and cost streams of various library systems at this stage led us to modify the comprehensive formula proposed to calculate this ratio.

4.14 The denominator E_i of the benefit-cost ratio refers to capital and operating costs. Since we did not estimate patterns of future cost streams for different library systems we have confined our analysis to cost figures for the latest year, 1974. These cost figures from published annual reports refer to a composite of recurrent and capital expenditure. Nearly 70% of these costs are attributable to wages and salaries of staff of public libraries and the balance 30% to additions to book-stock, purchase of equipment etc.

User and Non-User Benefits or Social Benefits

4.15 The formula proposed captures only user benefits of public library services. But social benefits of a public utility are the sum total of user and non-user benefits. Sufficient data are not available in non-user surveys to quantify the "spill-over effects" or externalities that arise to the community as a whole due to the existence of library services. Studies for the United States[10] reveal that non-user benefits may constitute at least 25% of the user benefits in the benefit component of the above formula. In the absence of other information it would be justifiable to inflate the benefit component of the benefit-cost ratio by a factor of 1.25. Several reasons could be adduced for the valuation of non-user benefits: (i) It is a kind of option value which allows the non-users to become users in the future if an opportunity arises.[11] (ii) It may be that non-users may have a sense of fulfillment in seeing that their community or locality is ser-

8. Newhouse and Alexander, op. cit. p. 38.
9. Report of the Committee of Inquiry into Public Libraries (1970, p. 33).
10. Hu, et al. op. cit. The 25% is an average from the data given in Table 30, p. 202.
11. W.L. Hansen and B.A. Weisbrod, Economics of Military Draft, Quarterly Journal of Economics, August, 1967.

viced by a public library. (iii) The existence of library service would confer external benefits on the community by broadening community awareness and civic consciousness. (iv) The existence of library facilities would be helpful to children and may reduce social evils like juvenile delinquency. A survey specially designed to evaluate the monetary values of various benefits perceived by non-users could provide measures of these factors. Quantifiable information is lacking in non-user surveys available for Australian public libraries.

Modified Version of the Benefit-Cost Ratio

4.16

$$\text{Benefit-Cost ratio: } \frac{B}{C} = \frac{\sum_i Q_i P_i f_{bi}}{\sum_i E_i}$$

i : i-th public library system
Q_i : circulation of the i-th library system
P_i : average price or valuation of a unit of circulation of the i-th library system
E_i : current expenditure of the i-th library system
b : users satisfaction valued as a fraction of purchase price of a book
f : inflation factor to account for non-user benefits.

The modified formula gives the current operating efficiency or social benefits generated by the i-th library system in the given year or current year. In other words, the absence of time profiles of benefit and cost streams for library system operations compels us to abandon discounting over time. The paucity of data in published reports and the ABS questionnaire prevents the implementation in full, of the ratio propounded in 4.8. Nevertheless, its modified version is operational in the context of the data constraints. Since this is the first time an objective measure of ranking the efficiency and social benefits of library systems has been attempted for Australia, we venture to present it here, despite its manifold limitations.

Empirical Results of Applying the Modified Benefit-Cost Ratio

4.17 It must be borne in mind that the modified benefit-cost ratio suffers from several conceptual and data limitations. The data base for the computation of the ratio was the same as in Chapter 3. The ratio gives a ranking of circulation per dollar of annual expenditure and describes the benefits associated with the use of circulation as a surrogate variable for benefits generated by public libraries. If the benefit-cost ratio is greater than unity it implies that a dollar spent on a library system generates more than a dollar's value of benefit. Table 4.1 gives for different library systems expenditure or costs, which is the denominator of the ratio, and user plus non-user benefits which is the numerator of the ratio.

4.18 In New South Wales the ranking of library systems in decreasing order of benefit-cost ratios is country, regional, joint and metropolitan. For Victoria the ranking of benefit-cost ratios in descending order of magnitude indicates the following pattern: rural-regional, rural non-regional, urban regional, urban non-regional. For Queensland the ratio ranking in descending order of magnitude indicates the following pattern: subscription, free, regional. For Western Australia the urban library system yields a benefit-cost ratio which is better than rural.

Table 4.1. Benefit-Cost Ratios

State	System	Expenditure ($)	User Benefits ($)	Social Benefits or (User & Non User) ($)	UB / E (User Benefits / Expenditure)	Social Benefits / Social Costs *
N.S.W.	Metropolitan	8,810,620	6,326,517	7,908,147	.718	.898
	Country	2,690,768	3,033,576	3,791,970	1.127	1.409
	Joint	2,596,158	2,161,720	2,702,150	.833	1.041
	Regional	1,238,198	1,185,360	1,481,701	.957	1.197
	TOTAL	15,335,744	12,707,177	15,883,972	.800	1.036
Victoria	Urban Non Regional	3,130,544	2,021,832	2,527,291	.646	.807
	Urban Regional	2,958,045	2,048,233	2,560,291	.692	.866
	Rural Non Regional	191,149	134,745	168,431	.705	.881
	Rural Regional	1,023,913	978,044	1,222,555	.955	1.194
	TOTAL	7,303,647	4,182,868	6,478,585	.710	.887
Queensland	Free	1,436,649	1,579,565	1,974,456	1.097	1.374
	Regional	368,244	154,845	193,557	.421	.526
	Subscription	63,040	152,932	191,165	2.426	3.032
	TOTAL	1,867,936	1,907,427	2,384,284	1.021	1.276
Western Australia	Urban	1,544,102	1,705,381	2,131,727	1.104	1.381
	Rural	229,800	140,134	175,168	.610	.762
	TOTAL	1,773,902	1,873,362	2,341,703	1.056	1.320
South Australia	TOTAL	566,384	875,711	1,094,639	1.546	1.933
Tasmania	TOTAL	441,574	1,299,378	1,624,223	2.942	3.678

Sources: Queensland: *Statistical Bulletin* 1974/75
New South Wales: Report of the Library Council 1974/75
Other States: ABS Survey 1975

* Note: This does not purport to include *all* social benefits and costs, and is an approximation only.

4.19 The ranking of benefit-cost ratios between States is as follows: 1. Tasmania, 2. South Australia, 3. Western Australia, 4. Queensland, 5. New South Wales, 6. Victoria. The ranking results should be interpreted with caution. For instance, the overall ranking of systems indicate that rural country systems for New South Wales and Victoria are better than the metropolitan. The regional systems in all States perform better than urban or metropolitan. However, in Western Australia the urban figure is better than rural systems in New South Wales, Victoria and Queensland.

4.20 Table 4.1 indicates a very high benefit-cost ratio for subscription libraries in Queensland vis-a-vis free libraries. This figure should be interpreted with circumspection. However, in the context of the crude benefit cost ratio it means that the subscribers are well compensated in terms of benefits for their subscription in spite of suspected shortcomings in the quality of inputs. Indirectly, this indicates that increased expenditure on subscription libraries may result in high social payoffs. The figures also show a very high benefit-cost ratio for Tasmania in the comparison of the crude ratio. However, it must be borne in mind that the cost figures do not cover all local libraries nor all staff payments. This exclusion inflates the ratio.

4.21 The benefit-cost ratio rankings derived on the basis of the modified formula indicate the relative performance of different library systems in Australia in relation to the provision of basic services, as measured by circulation only. The quality of library services as indicated by the reference collections, and other non-circulation services like audio-visual aids, photocopying, and inter-library loans are not captured in the crude benefit criterion we have used. Furthermore, the quality of service that is associated with qualified staff is not reflected in the computed benefit-cost ratio. The costs due to non-circulation services like referral, audio-visual, fine art collections and investment in qualified staff inflate the denominator of the modified ratio and thus overstate the costs of circulation services. The repercussions on benefits in terms of the quality of services are not reflected in the numerator which ignores the value of quality of library services. To make the benefit-cost ratios take account of quality of service, user surveys of these operations would have to be quantified by mounting special purpose surveys. For the present, we can only state that the benefit-cost ranking that we have derived may be inversely related to the quality of services provided by the library systems ranked.

4.22 Despite these limitations the computation of objective measures is a worthwhile process, since at least it throws into clear relief gaps in basic information that have to be made good in order to monitor and report efficiency of public library systems and their operations meaningfully.

Chapter 5
Costs of Individual Library Activities

5.1 It is apparent that the measures of efficiency developed so far are broad summaries of overall operating efficiency, and may not reflect the efficiency of certain aspects of a given library service. It is necessary to recognize that each library is engaged in several internal activities,[1] which may be performed with varying degrees of efficiency, and provides to outside users several services which may also be produced with varying efficiency by different libraries. In this Chapter, it is implicitly assumed that the size of the library or of the individual activity is an important determinant of the efficiency of that library or activity.

The separation of the activities of the library is also necessary in order to provide information on the prospects for rationalisation or regionalisation of library systems. Certain internal operations might be performed more efficiently by libraries of a certain size. Similarly, some services may be provided at a lower cost per unit in small libraries, while others may be provided at a lower cost in large libraries.

Questionnaire

5.2 The information required to study these questions was not provided in the questionnaire which the Committee circulated to all municipalities in Australia and which was processed by the Australian Bureau of Statistics (ABS). It was decided therefore to approach a number of libraries with a request for further information, to be recorded in a small questionnaire, designed to achieve a separation of direct costs into the costs incurred by each of nine specified activities or operations.[2] The questionnaire also included questions on other matters which were not covered in great detail, or not at all, in the ABS questionnaire.

5.3 The aim of the survey was not to select a random sample of libraries from the population of all public libraries, but rather to include libraries which covered a range of sizes, and to have different geographical and organizational types represented. It is possible that the sample selected is biassed towards the more "efficient" libraries, since two factors influencing a library's inclusion were the likelihood of engaging its cooperation, and the expected quality (i.e. accuracy) of the information it might provide.

The questionnaire is reproduced as Appendix C. A pilot run was not tested, so that in some ways the investigation reported herein might be considered a pilot for a further study with wider coverage at a later date.

5.4 The sections of the questionnaire which are involved in the primary concern of this chapter are Question 3 on Form A, and all of Form B. Question 3, Form A, presents a list of operations which were intended to be mutually exclusive and exhaustive. It was apparent, however, that doubts arose on some matters. For example, evidence suggests that many libraries may have included the costs of repairs to books in the costs of end-processing, since locationally they are incurred in the bindery. A case

1. In this section, the words *operation* and *function* will be used to refer to individual activities such as acquisition, cataloguing etc.
2. Direct costs are defined here as those which are directly identifiable with a specific operation.

may be put, however, for the inclusion of these costs in the cost of circulation. The variety of accounting procedures which are followed by different libraries may reduce the comparability of the figures given in answer to Question 3. For example, a cost that may be included in overheads in one library, and thus not included on this form, may be able to be identified with a specific operation in another. With this and other problems in mind, emphasis will be placed on the labour component of direct costs, which comprise 77.8% of total direct costs for libraries in this sample. Information on labour costs was sought in Form B, Appendix C.

The labour cost of each operation is calculated by multiplying each staff member's earnings by the percentage of time spent on that operation, and summing these amounts for all staff members. The total direct cost for each operation is obtained by adding to this sum the amount of "materials and other direct cost" for that operation recorded on Form A.

Comparisons of Average Costs of Individual Operations

5.5 Two definitions of total cost are used for the purposes of this Chapter: (1) total labour costs, and (2) labour costs plus materials and other direct costs, called "total direct costs". These give rise to two definitions of average cost. In general, the average cost of an operation is the total cost divided by a measure of output or throughput of that operation.

The primary aim of this part of the study was to investigate the behaviour of the average cost of performing the individual operations as the measure of output of the operation changes. Conventional economic theory suggests that as the output of a firm increases, the average cost of producing may at first decline but later rise. The same broad "U" shape is also often expected to occur in the relationship between average cost and output for a number of firms across a wide range of plant sizes. It is of interest here to observe if any recognizable tendencies are revealed in the behaviour of the average cost of individual library operations.

5.6 The definitions of average cost of the various operations are stated. In each case, both definitions of total cost were used.

1. Average acquisition cost $= \frac{\text{total acquisition cost}}{\text{number of books added}}$
2. Average cataloguing cost $= \frac{\text{total cataloguing cost}}{\text{number of books added}}$
3. Average end-processing cost $= \frac{\text{total end-processing cost}}{\text{number of books added}}$
4. Average circulation cost[3] $= \frac{\text{total circulation cost}}{\text{circulation}}$
5. Average inter-library loan cost $= \frac{\text{total inter-library loan cost}}{\text{number of inter-library loans}}$

The denominators in the above averages may not accurately reflect the throughput of the operations in question. For example, cataloguing costs may include the costs of re-cataloguing existing books, as well as of cataloguing newly acquired ones. The cost of processing inter-library loans may be more closely related to the number of loans received, than to the total number of loans made and received, which is used here.

5.7 The operations numbered 6 through 9 in the questionnaire present even greater problems for the choice of an appropriate measure of output or throughput. As a first step, however, some surrogate variables were considered.

3. The cost for 4 may still be underestimated, since costs associated with "production of catalogues" have been included in the cost of end-processing.

The existence of a library's non-fiction bookstock may attract use of its reference and photocopying facilities. Thus, in the absence of information on the number of reference enquiries and the physical output of the photocopying equipment, the following average costs are defined:

6. Average reference cost = $\frac{\text{total reference cost}}{\text{non-fiction bookstock}}$

7. Average photocopying cost = $\frac{\text{total photocopying cost}}{\text{non-fiction bookstock}}$

Special programmes are aimed at the whole or part of a library's public, both users and non-users. An estimate of the "catchment population" of the library was sought in Question 5, Form A, of the questionnaire. It is suggested that expenditure on special programmes be divided by the size of that section of the population at which they are aimed, and which have special needs or interests. In the absence of good information on the size of such sub-populations,[4] the following definition was used:

8. Average special programmes cost = $\frac{\text{total special programmes cost}}{\text{catchment population}}$

This "average cost" should not be interpreted as a measure of the efficiency of the operation, but rather as an indication of the effort made by the library to service the needs of its public or sections of it.

The output of the administrative function is similarly difficult to identify. Two particular aspects of it are the management of the library's resources, and the management of its output, most simply identified as its circulation. Thus two definitions of average cost are suggested:

9.(a) Average administration cost = $\frac{\text{total administration cost}}{\text{bookstock}}$

(b) Average administration cost = $\frac{\text{total administration cost}}{\text{circulation}}$

5.8 Appendix D.1 gives the average cost of each operation for each library in the sample, using the first definition of total cost (i.e. total labour costs). Appendix D.2 gives the average costs calculated from the second definition of total costs (i.e. total direct costs, including labour).

The behaviour of the average costs of each operation will now be discussed.

Acquisition, Cataloguing and End-processing

5.9 Table 5.1 presents the average cost of these operations, on both definitions of cost.

Acquisition

Figure 5.1 illustrates the relationship between average labour costs of acquisition and the number of books added (additions). A tendency for the average cost to decline as additions increase is evident, apart from the observations for four libraries which added only 3-6,000 books but which still achieved comparatively low average costs. Three of these were rural-regional library services. Since labour comprises 92.5% of the total direct costs of acquisition in this sample, the pattern for total direct costs is very similar, and is not illustrated.

5.10 It is instructive to compare aspects of the performance of the acquisition operation in the libraries which differed markedly from the pattern, with others in similar

4. For example, the size of the migrant population; the number of people in special institutions within the catchment area.

Table 5.1. Average Costs of Acquisition, Cataloguing, and End-Processing

		Labour Costs Per Addition ($)				Total Direct Costs Per Addition ($)			
Library	Additions	1 Acquisition	2 Cataloguing	3 End-Processing	1+2+3 Total	4 Acquisition	5 Cataloguing	6 End-Processing	4+5+6 Total
3	36000	.77	.57	.57	1.91	.96	.76	.85	2.57
1	26603	.71	3.39	1.88	5.98	.72	3.42	2.13	6.27
4	20544	1.38	1.94	2.88	6.20	1.40	2.04	3.76	7.20
6	19245[1]	.96	2.65	2.20	5.81	1.20	3.42	3.18	7.80
5	13307	.55	1.46	1.23	3.24	.58	1.52	1.41	3.51
2	13148	1.57	.99	3.00	5.56	1.69	1.13	3.92	6.74
10	8929	2.45	4.79	.08	7.32	2.50	5.48	1.42	9.40
7	5815	.68	1.25	4.49	6.42	.68	1.25	4.59	6.52
8	4419	.89	1.62	2.79	5.30	1.03	1.75	2.93	5.71
13	4110	.66	1.36	.92	2.94	.76	1.37	1.00	3.13
9	3110	3.99	1.64	3.42	9.05	4.00	1.65	3.58	9.23
14	3032[1]	2.85	4.55	1.37	8.77	2.90	4.59	1.86	9.35
16	2711	1.01	.40	3.60	5.01	1.03	.59	3.99	5.61

Notes: 1. Figure for 1973–74.

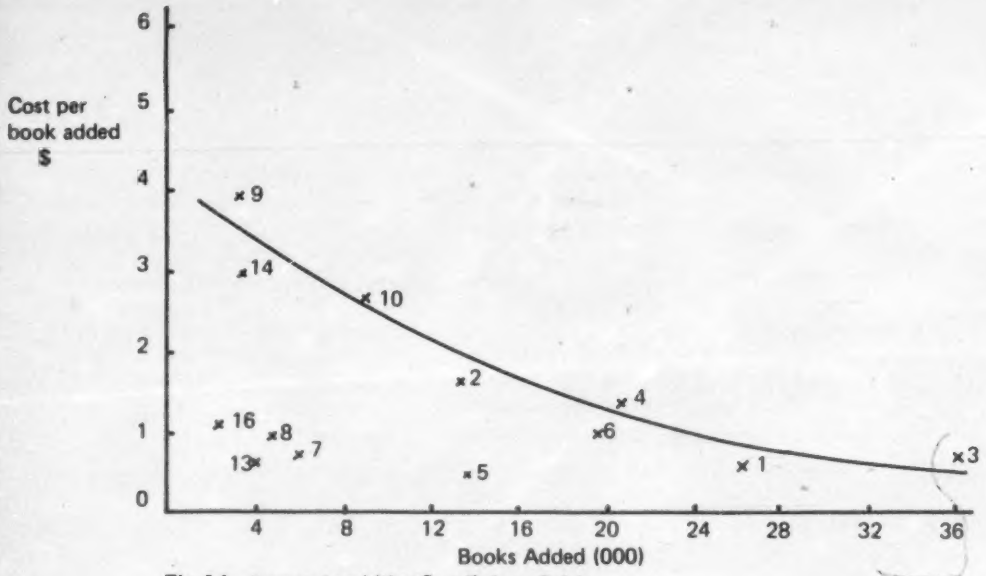

Fig. 5.1. Average Acquisition Cost (Labour Only)

Table 5.2.

Library No.	Books Added	Average cost (labour) $	No. of staff involved / Total Staff	Average percentage of time spent on acquisition by those involved	Labour costs of acquisition / Total Labour Cost %
8	4,419	.89	9/12	5.5	4.2
13	4,110	.66	2/6	17.5	6.6
9	3,110	3.99	11/12	15.8	17.5
7	5,815	.68	3/22	13.3	3.2
10	8.929	2.45	13/21	22.0	12.6
3	36,000	.77	17/42	23.7	10.7
1	26,603	.71	7/59	38.9	4.6

ranges which exhibited higher average costs. There is some tendency for the libraries which achieve lower average costs to have a smaller porportion of their staff involved in acquisition, and for these staff to spend a smaller proportion of their time on that task than staff in libraries exhibiting higher average costs. This might imply efficiency results from specialisation. These comparisons are presented in Table 5.2.

The two libraries in the sample which added the most books exhibited comparatively low average acquisition costs. These are both urban-regional systems, and it is known that one, (3), has introduced computer methods into this operation, as well as into cataloguing, end-processing, and circulation. For that library, the percentage of labour in total acquisition costs is 80.0%, compared to 99% for 1, and 92.5% for the sample average. This also reflects the substitution of capital inputs (viz. computer) for labour. In 1, acquisition is dealt with by only seven staff members, whose average earnings were $8,257. The operation required the involvement of seventeen staff in 3, but their average earnings were lower, $7,862.

Cataloguing

5.11 Fig 5.2 illustrates the pattern of average cataloguing costs, based on labour costs only. These comprised 90.2% of all direct costs of cataloguing for the sample.

If the observations for 10 and 3 are taken as special cases, it is perhaps possible to see a "U" shape in the scatter of observations, with the low point of the U in the region of 9,000 additions. Again it is tempting to suggest that the use of computers in 3 explains the comparatively low average cost for the large number of additions, but 10 also reported that a computer is used in the cataloguing operation. In explaining the average cost for 10 it may be significant that average end-processing cost in this library is extremely small compared to other libraries in the same range. It is possible therefore that staff members included some of the time spent on end-processing under cataloguing. This suspicion is strengthened by the observation that 10 spent 24.7% of its salaries bill on cataloguing, while 7, which acquired a similar number of books, spent only 5.9%. The average for the sample was 12.1%. Library 10 reported that fourteen of its twenty-one staff members were involved in cataloguing, while in 7, there were only three out of twenty-two. These comparisons strengthen the suggestion that specialisation may enhance efficiency, if this can be measured by average costs as defined in this study.

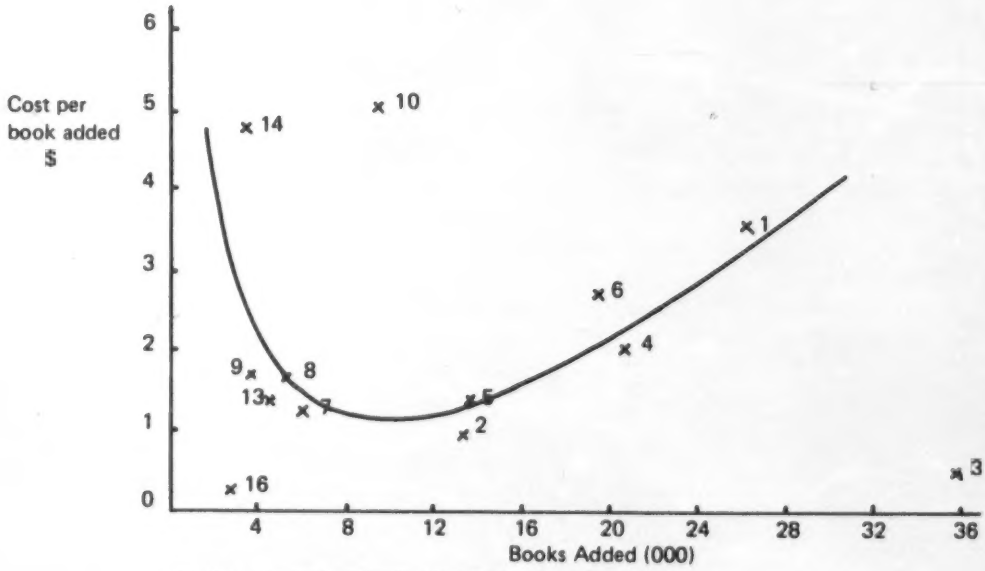

Fig. 5.2. Average Cataloguing Cost (Labour Only)

5.12 The low average cost of acquisition achieved by 1 was not matched by its performance in the cataloguing operation. Its average cataloguing cost of $3.39 is substantially higher than most libraries which acquired fewer books. This tendency for high average cataloguing costs was shared by 4 and 6 which also acquired large numbers of

books . These are all urban libraries with several service points (eighteen, six, and four respectively). The provision of catalogue records for each service point (if this is done) may partly contribute to the comparatively high average cataloguing costs exhibited by these systems.[5]

End-Processing

5.13 Fig 5.3 illustrates the behaviour of average costs of end-processing as the number of books acquired changes. It is possible to discern a tendency for average cost to decline as the number of books added increases, but only if four observations are disregarded.[6] These are 14, 13, 10, and 5. The library which diverges most from the broadly falling trend is 10. The extremely low average end-processing cost for this library should perhaps be considered in the light of its comparatively high average cataloguing cost. As was suggested in the discussion of Fig. 5.2 above, it is possible that labour costs which other libraries included as end-processing costs have, in 10, been included as cataloguing costs. The comparatively low value calculated for 14 may be partly explained by its inclusion of the costs of book repair under circulation costs, while it is suspected that many other libraries included these costs under end-processing.

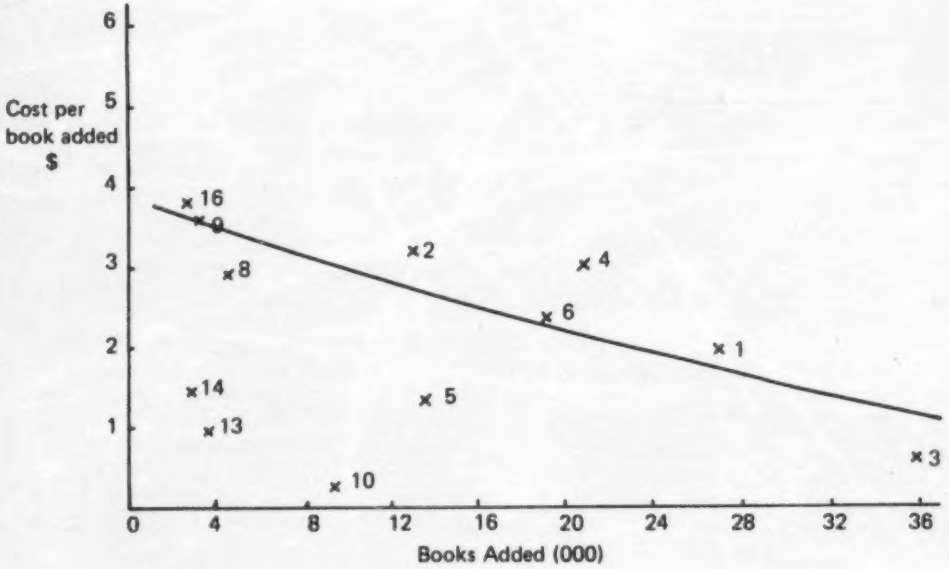

Fig. 5.3. Average End Processing Cost (Labour Only)

5. It should be stressed, however, that this is only a partial measure of the efficiency of the cataloguing process, which is an investment activity whose ultimate aim is the extensive and intensive use of the bookstock by the public. It is observed, (Appendix D.6) that the ratio of circulation to bookstock for the libraries which exhibit comparatively high average cataloguing costs compares well with others in similar ranges, and for 4, is among the highest in the sample. This may be due to the high cost, but effective, cataloguing system.
6. The number of books added may only be an approximate measure of the volume of throughput which contribute to the cost of this operation, in which case the relationship between these two variables could only be weak.

The low average cost for end-processing in 3 may again be related to its substitution of capital for labour by the use of the computer. The allocation of data processing costs, in 3, to the operations which benefit from the use of the computer does, however, raise a problem. Total data processing costs of $23,733 were reported as direct costs, but this total was not apportioned between the operations which benefitted, namely acquisition, cataloguing, end-processing, and circulation. In this analysis, the total was distributed equally among the four operations. A preferable method of distribution may have been to make the assumption that the computer system substitutes largely for the labour input, and to distribute data processing costs by using weights derived from the labour costs of performing these operations in a library of similar size.[7]

5.14 As mentioned above, evidence suggests that some libraries may have included the costs of book repair in end-processing costs. The effect of this is to overstate the average cost of processing newly acquired books. Library 6 was the only library which provided separate information on the costs of book repair. These costs have been included in end-processing costs in all Tables and Appendices in order to maintain consistency with other libraries which have treated these costs similarly. The following analysis however, illustrates the differences that emerge from the two alternative treatments.

	End-processing costs: repair costs included	repair costs excluded
Labour costs	$42,323	$8,673
Percentage of total labour costs	12.09%	2.47%
Average labour cost	$2.20	$0.45
Materials and other costs	$18,857	$3,864
Percentage of total materials and other costs	15.7%	4.3%
Average cost (all direct costs)	$3.18	$0.65

If these comparisons are indicative of the cost structure in other libraries in the sample, the average end-processing costs may have been overstated. On *a priori* grounds, it would seem that book repair is more closely associated for costing purposes with the function of circulation rather than with end-processing.

5.15 It may be instructive to calculate the combined costs of performing the three operations, acquisition, cataloguing, and end-processing. These are also presented in Table 5.1. It is not possible to discern a pattern in the average costs of the combined operations, on either definition of cost. This reflects the previous observations that individual operations exhibit dissimilar trends; acquisition and end-processing showing decreasing average costs as additions increase, with cataloguing displaying a rudimentary "U" shaped trend.

Circulation

5.16 Average circulation costs are shown in Table 5.3.

No pattern can be discerned in these figures. Library 3 again exhibits a comparatively low unit cost. Some large apparent discrepancies may be explained on closer investigation. Library 14 has a similar total circulation to library 12, but nearly

7. This was done for library 3, using weights derived from library 1. Average acquisition and end-processing costs were reduced, while average cataloguing and circulation costs were increased, but not sufficiently to alter the overall pattern which emerged.

Table 5.3. Average costs of Circulation ($)

Library	Circulation	Circulation Cost (labour) / circulation	Circulation cost (total) / circulation
9	162,349	.10	.12
11	169,471	.18	.19
14	170,577	.26	.26
12	185,196	.09	.09
13	215,815	.09	.09
16	240,686	.09	.09
15	245,612	.06	.07
10	306,364	.16	.17
8	331,467	.13	.13
5	461,730	.05	.07
7	502,914	.09	.10
3	708,070	.09	.12
6	766,060	.16	.21
2	888,281	.13	.14
4	1,121,000	.15	.16
1	1,176,139	.11	.11

three times its average circulation cost. It was reported that 14 includes the costs of repairs (an unspecified amount) in the costs of circulation, which appeared to be an uncommon practice in this sample, but in the opinion of this writer makes for a more meaningful estimate of circulation cost. This practice may also explain the low average end-processing cost ($1.37) exhibited by this library in comparison with others in the same range ($3.42 for 9). Another library, 6, reported that it included the cost of "shelf-tidying" in the cost of circulation. This process entails the sorting of all stock into "exact order" each morning, and requires the use of all available staff for 1-1½ hours per day. It is therefore probably not surprising that it exhibited the comparatively high average circulation cost of $0.16. The "benefit-cost" ratio of this particular process might be the subject of further investigation. Different methods of recording inter-branch loans and their costs may also help explain differences in average circulation costs in this sample. Perhaps the most that can be said is that average circulation costs appear to be less related to the throughput of the operation than are the average costs of some other operations.

Inter-library loans

5.17 Table 5.4 presents the average costs of the operation for sample libraries. Fig. 5.4 illustrates the pattern of the average labour cost of inter-library loans (I.L.L.). A declining trend as the number of loans increases is evident, implying that libraries which handle more transactions do so more efficiently in terms of average cost. A similar pattern is revealed if all direct costs are included. These results may have implications for decisions concerning regionalisation of library systems.

It is not known how many respondents included the cost of inter-branch loans in the cost of inter-library loans. One library (1) reported these costs separately, and in the results presented herein the cost of inter-branch loans have been included in circulation costs for that library. To have included these costs in inter-library loans would have resulted in an average cost (all direct costs) of $23.82, which appeared to be greatly distorted.

Reference and Photocopying

5.18 Table 5.5 presents the costs of these operations in the libraries sampled.

Table 5.4. Average Costs of Inter-Library Loans

Library	Inter-Library Loans	Cost per Loan (Labour) $	Cost per Loan (All Direct Costs) $
4	2,612	2.87	3.13
2	1,580	4.73	5.08
1	1,223	4.21	5.49
5	1,121	.91	1.45
7	547	7.08	7.54
3	488	7.58	7.94
13	442	1.98	2.50
14	357	9.59	9.65
16	232	7.39	7.48
9	190	15.31	15.60
8	145	25.61	26.13
10	66	14.33	16.76

Table 5.5. Cost of Reference and Photocopying Operations

Library	Non-Fiction Bookstock	Reference Cost per N.F. Book (Labour) ($)	Photocopying Cost per N.F. Book (Total Costs) ($)
16	11,114[1]	1.35	–
13	13,391	.38	.15
14	13,452	.94	.25
10	18,206	1.41	.07
11	20,430	.38	.12
7	25,640	.59	.13
9	28,839	.19	.08
8	30,981	.25	.05
6	48,543	.98	.19
2	73,998	.41	.01
4	74,224	.80	.19
3	75,555	.58	.11
5	79,484	.39	.07
1	165,588	.32	.04

Table 5.6. Expenditure on Special Programmes per Capita

Library	Catchment Population	Most Recent Nominal Population 1974 or 1975	Catchment pop. / Nominal pop.	Expenditure per capita (catchment) ($)
1	367,000	148,400	2.47	.02
3	278,351	224,100	1.24	.07
2	250,000	135,510	1.84	.08
4	250,000	158,280	1.58	.07
6	205,000	163,300[2]	1.26	.13
5	107,000	65,920	1.62	.03
11	85,000	32,000	2.66	.08
10	80,000	61,500	1.30	.13
7	65,000	69,010	.94	.16
12	57,000	22,860	2.49	.04
9	36,000	32,750	1.10	.21
8	35,000	35,050	1.00	.08
15	31,000	29,890	1.04	.01
14	30,000[1]	28,800	1.01	.11
16	26,000	26,470	.98	.08
13	24,000	22,924	1.05	.05

Notes: 1. Nominal population, 30/6/71.
2. Figure for 1973.

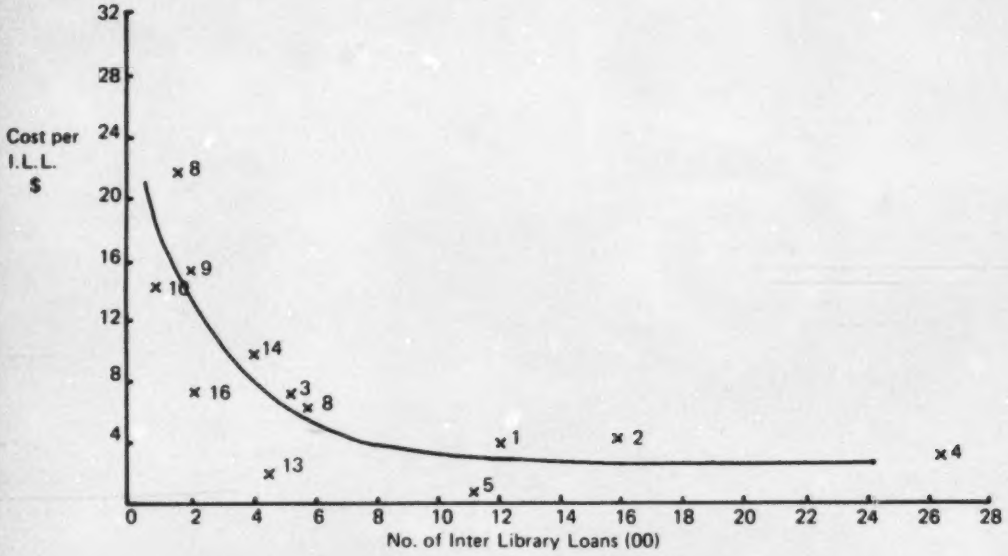

Fig. 5.4. Average Inter Library Loan Cost (Labour Only)

It is not possible to discern a pattern in either of these series. It is stressed, however, that the size of the non-fiction bookstock is likely to be a very imperfect indicator of the output of these operations. The questionnaires returned contained little evidence which might explain the particularly high estimates calculated for some libraries. Library 6 drew attention, however, to the difficulty of separating the operations of circulation and reference.

Evidence suggests that the quality of the information collected on photocopying costs is variable. For example, one library reported a cost of zero for this operation, on the grounds that it "showed a profit".

Special programmes

5.19 Table 5.6 gives the amounts expended on special programmes by the libraries per member of the catchment population. More information is required on the social and financial environments of particular libraries before explanations of observed differences can be suggested, or the adequacy of expenditures judged. It is only possible to draw attention to the width of the range of per capita expenditures observed.

Administration

5.20 Table 5.7 presents the costs of administration, on both definitions of cost, per unit bookstock and per unit circulation.

The absence of recognizable patterns in these series may derive partly from different accounting practices of recording certain expenses. "Administration" may be used as a catch-all heading, in some libraries, while others may be able to allocate the same expenses to specific operations, or on the other hand prefer to treat them as overheads.

Table 5.7. Direct Costs of Administration ($)

Library	Bookstock	Circulation	Labour Costs		Total Direct Costs	
			Per Unit Bookstock	Per Unit Circulation	Per Unit Bookstock	Per Unit Circulation
1	291,877	1,176,139	.19	.05	.52	.13
2	192,558	888,281	.15	.03	.15	.03
3	189,261	708,070	.29	.08	.47	.13
4	181,338	1,121,000	.33	.05	1.69	.27
5	136,057	461,730	.20	.06	.20	.06
6	133,081	766,060	.24	.04	.32	.06
7	75,157	502,914	.10	.02	.17	.02
8	75,053	331,467	.17	.04	.25	.06
9	74,039	162,349	.11	.05	.27	.12
10	59,496	306,364	.33	.06	.53	.10
11	50,438	169,471	.22	.07	.50	.15
12	36,000	185,196	.08	.02	.16	.03
13	35,999	215,815	.06	.01	.09	.02
14	32,935	170,577	.70	.14	.87	.17
15	32,000	245,612	.11	.02	.12	.02
16	30,308	240,686	.24	.03	.38	.05
Sample Av.	101,600	478,233	.22	.05	.50	.11

Other Information Collected in the Questionnaire

(a) Classification of bookstock by type of use

5.21 Question 1, Form A, was asked with a view to distinguishing between the markets, or functions, which a library serves. As a first approximation, it was suggested that the stock of adult-fiction material might be identified with the entertainment market, while all other books might be identified with the "information/education" market. Of course, the overlap between these two is readily recognized. However, it was felt that information on the expenditure devoted to these two classes of books might give some indication of the difference in emphasis placed by different libraries on these two "markets". It was found, however, that most libraries do not record information on expenditure on books in this form. Nor would it have been possible to calculate a unit cost of each type of book, which might have revealed interesting comparisons, since figures were not available, or sought, on the number of each type of book added to the bookstock in a particular year.

(b) Capital inputs

5.22 A notable gap in the body of data on the resources available to public libraries is information on the value of capital resources. The total current costs of library services should include a component which takes account of the capital assets used. In economic terms, a measure of the "social opportunity cost" is sought, to which an approximation might be the rental value of the library premises. It would be very difficult to estimate this for many public libraries. In accounting terms, the capital component of current costs is depreciation, based on some concept of "value" of the asset. To obtain estimates, based on consistent definitions, of the value of capital assets used by public libraries would also require a fairly major investigation. A first step was taken, however, in the ABS questionnaire. It was felt that improvements were possible in both the clarity of the question and the detail recorded, and so the supplementary questionnaire reported on here included a question on capital expenditures. A summary of the information received is presented in Table 5.8.

Table 5.8. Capital Expenditure by Sample Libraries (5)

Library	Bookstock	1971/72 Buildings	1971/72 Equipment	1972/73 Buildings	1972/73 Equipment	1973/74 Buildings	1973/74 Equipment	1974/75 Buildings	1974/75 Equipment	Totals Buildings	Totals Equipment	Grand Total
1	291877	–	833	–	2611	82302	19885	–	10553	82302	33882	116184
2	192558	–	6000	–	5500	–	632	250000	18000	250000	30132	280132
3	189261	–	–	–	4854	125000	11174	130000	31839	255000	47867	302867
4	181338	–	5464	–	14183	–	N.A.	–	8500	–	28147	28147
5	136507	–	6275	6856	5083	5741	9942	170	5450	12767	26750	39517
6	133081	–	421	–	3745	–	3458	–	22980[1]	–	30604	30604
7	75157	5500	1400	–	1600	–	13500[1]	60000[2]	20000[1]	65500	36500	102000
8	75053	–	1443	–	1536	4614	1525	–	1435	4614	5939	10553
9	74039	–	230	–	63	–	382	–	25259[1]	–	25934	25934
10	59496	254675	1176	206973	7216	6582	3838	–	386	468230	12616	480846
11	50438	–	95	–	379	–	377	–	1911	–	2762	2762
12	36000	–	986	–	1075	–	1750	–	3860	–	7671	7671
13	35999	–	421	–	585	–	18526[1]	–	1600	–	21132	21132
14	32935	5627	1019	6770	261	6952	918	6120	1192	25469	3390	28859
15	32000	2248	596	1735	147	5231	661	4675	1252	13989	2656	16645
16	30308	1879	–	1268	1155	1457	174	1625	81	6229	1410	7639
	Totals	269929	26359	223602	49993	237979	86742	452590	154298	1184100	317392	1501492

1. Bookmobiles have been included as equipment.
2. This figure does not include $150,000 being outlayed on new branch library in 1975–76.

(c) Intensity of usage of bookstock

5.23 An indication of the degree to which a library's resources are used is the percentage of the (circulating) bookstock which is in circulation on an "average" day. Other methods are required to gauge the intensity of use of non-circulating resources.

Most libraries do not keep records which enable them to report this percentage directly. Thus the following method is used to estimate it.

The number of books lent per day (N) is given by the total circulation for the year divided by the number of days the library is open in the year. The number of books lent in a loan period, C, is given by the number of days the library is open in the loan period times N. The assumption is made that all books remain with the borrower for the entire loan period and no longer.[8] The intensity of usage is given by expressing C as a percentage of the circulating bookstock. In the absence of figures for circulating bookstock, total bookstock was used.

These figures are presented in Table 5.9.

Table 5.9. Intensity of Bookstock Usage

Library	Bookstock	Circulation	Intensity of Book Usage [1] (%)	$\frac{\text{Circulation}}{\text{Bookstock}}$
1	291,877	1,176,139	15[2]	4.03
2	192,558	888,281	18	4.61
3	189,261	708,070	27.6	3.74
4	181,338	1,121,000	24	6.18
5	136,057	461,730	12	3.39
6	133,081	766,060	44	5.23[3]
7	75,157	502,914	30.6	6.69
8	75,053	331,467	17	4.42
9	74,039	162,349	9	2.19
10	59,496	306,364	29.6	5.15
11	50,438	169,471	19.2	3.36
12	36,000	185,196	19.7	5.14
13	35,999	215,815	36	6.00
14	32,935	170,577	n.a.	5.18
15	32,000	245,612	32.8	7.68
16	30,308	240,686	30.5	7.94

Notes: 1. Calculated by $\frac{\text{Circulation}}{\text{No. of days open in a year}} \times \text{no. of days open in loan period} \times \frac{1}{\text{Bookstock}}$

2. A direct estimate, based on circulating bookstock only, was 30%.

3. Based on 1973–74 figures.

(d) An approach to alternative estimates of population

5.24 Official figures for the population of municipalities may not reflect the size of the population which uses, or potentially uses, public library services. The adequacy of these services should be judged in relation to the "catchment" population. The distinction between catchment and nominal populations is also relevant when considering the financing of the library. The distinction may also be particularly important for some metropolitan libraries where separation of residence from place of work significantly affects where the demand for library services is manifested.

It is recognised that if non-residents of the municipality do not have borrowing rights, then they do not belong to the catchment population for purposes of circula-

8. This assumption is inaccurate if returns before and after the due date do not average out. It appears that many libraries adopt a lenient fines policy which makes for a high proportion of overdue returns. This would tend to bias downwards the estimates calculated on the method described.

tion, but they may still belong to the catchment population for reference or other purposes.

Question 5 on Form A probed this distinction between the catchment and nominal populations. The information collected is presented in Table 5.10.

Table 5.10. Aspects of Catchment Population

Library	Catchment Population	5.2 Percentage of Non-Residents in Actual Users	5.3 Percentage of Non-Residents in in Catchment Pop.
1	367,000	5	53
3	278,351	6.4	20
2	250,000	10	20
4	250,000	2	36
6	205,000	6.5	20
5	107,000	10	39
11	85,000	n.a.	n.a.
10	80,000	10	25
7	65,000	0	2.3
12	57,000	15	60
9	36,000	5	10
8	35,000	1	1
15	31,000	5	0
14	30,000[1]	n.a.	n.a.
16	26,000	0	0
13	24,000	0.5	11.4

1. Estimated as equal to nominal population 30/6/71.

Chapter 6
Implications and Conclusions

General Overview of the Study.

6.1 It is currently almost a tenet of faith among those concerned about the development of public library services in Australia that large organizational units are more efficient (in some sense) than smaller units, and that amalgamation or regionalisation of libraries yields significant economies in terms of lower unit costs of operation. It behoves policy makers, however, to seek objective evidence that this article of faith has some corroboration in real world experience. The terms of reference of the research study reported herein pointed the authors fairly directly towards an investigation of the broad relationships that exist between the size of a public library system and its efficiency, inasmuch as this can be measured by the information available. It is felt that the results of this study include a substantial amount of evidence which is consistent with the article of faith mentioned above, although as usual, the evidence should be seen in the light of certain limitations and qualifications. For example, it should come as no surprise that no final verdict can be rendered on the question of the efficiency of a prospective regional library system serving a population of some 300,000 people, which is a figure which has been mentioned as some kind of "standard". The evaluation of such a proposal would require a basic change in direction from the investigation of historical cost data (used herein), to the synthesis of predicted budgets for systems not yet born. By the same token, the economic feasibility of the creation of new regions, (rationalisation of systems), can perhaps not be conclusively proven by the comparison of the costs of existing regional systems with those of existing independent libraries, since regions may be qualitatively and structurally unique. It is felt, however, that the evidence presented herein is at least highly suggestive. Detailed information was not sought on the particular structural and organizational characteristics of different library systems (for example, on the division of tasks within regions), but it is likely that many readers of this report will be better informed on these aspects than were the authors, and might thus be able to give plausible explanations based on grass-roots knowledge for many of the comparisons reported.

In spite of such qualifications, the authors feel that the results of this study point consistently to the conclusion that larger libraries and library systems incur lower unit costs; and that libraries in regional systems incur lower unit costs than comparable independent libraries.

Broad Summary of the Results.

6.2 A detailed description of the methods used, data to which they were applied, and the results obtained, are contained in Chapters 2 and 3, to which interested readers can refer. This section is intended to provide a non-technical presentation of the most suggestive results. The concepts of average and marginal costs have been explained in 1.3 and will be used here.

Costs in Queensland Public Libraries. (See Tables 3.1 to 3.6)

6.3 The relationship between total operating costs and circulation (linear relationship assumed): For most groups of libraries, the average cost of circulation declined as circulation increased. The exception was for certain libraries within regional systems, where average cost was observed to increase as circulation expanded. If each regional system was considered an indivisible entity however, it was found that average costs decline as the volume of circulation of the region as a whole expanded. The regional system appears to be quite expensive in terms of marginal costs: It costs 67 cents to circulate a book (at the margin) for the typical regional system, while the (independent) free libraries can do so for 34 cents. The average costs for these two types of libraries are $1.09 and 36 cents respectively. The geographically remote characteristics of these Queensland regions might certainly contribute to an explanation of these comparisons. The apparently efficient performance of subscription libraries in Queensland must be seen in the light of quality and range of services provided, and bearing in mind the fairly poor fits of the functional forms to the data. The above figures refer to current costs, i.e. excluding capital costs.

6.4 The inter-relationship of operating costs with factors other than circulation was also studied with reference to Queensland data. It was found that, for free libraries, changes in population served were positively related to operating costs, as was the number of books added, and the number of full-time staff. No other "explanatory" factors passed conventional tests of statistical significance. The inter-relationships of some nine variables were investigated with reference to Queensland data.

Costs in New South Wales Public Libraries. (Tables 3.9 and 3.10)

6.5 The joint libraries in this State revealed rising average costs. These are largely amalgamations of rural town councils with the local shire councils. All other systems (metropolitan, country, and regional) exhibited falling average costs. The country independents exhibited the lowest marginal and average costs (35 cents and 41 cents respectively), but this might be explained again by the quality of both inputs and outputs. For the same reason, the relatively high marginal and average costs of the metropolitan libraries (43 cents and 65 cents respectively) may not imply inefficiency. It is notable however, that the largely urban regional library systems can achieve lower marginal and average costs (40 cents and 49 cents respectively) than the metropolitan independents, which perhaps provide a similar quality of service.

Costs in Victorian Public Libraries. (Tables 3.11 and 3.12)

6.6 If the relationship between total costs and circulation is assumed to be linear, then all library systems in this State exhibit decreasing average costs as circulation expands. If an alternative assumption is made (i.e. that the relationship is logarithmic), the non-regionalised rural libraries are observed to experience increasing average costs as output expands. This alternative assumption better fits the data for this group of libraries. Furthermore, the rural non-regional libraries experience higher marginal costs of circulation than those in any other system (61 cents compared with 32 cents for regionalised rural libraries). Their average costs are also higher than those of the rural regional systems (66 cents compared with 40 cents). It is also seen that the urban regional libraries can achieve lower marginal and average costs than their non-regionalised neighbours, (marginal costs are 45 and 48 cents, average costs 67 and 72

cents respectively). Again the cost comparisons between urban and rural libraries are influenced by quality differences.

Inter-State Comparisons.

6.7 Cost functions were also fitted to data for all library organizational units in each State. The results are summarised in Tables 3.13 and 3.14. These Tables show, for example, the summary of cost experience of the whole range of libraries in each State, where "library" is defined as the autonomous organization unit (e.g. regional system) rather than the service point. The fit of the linear function is acceptable in all States, and reveals that only in Western Australia are average costs increasing as circulation expands. However, based on the alternative assumption of a logarithmic relationship between costs and circulation, this State exhibits falling average costs. In any event, it would be unwise to make the usual inferences about efficiency from the results from this State, for it operates as an interdependent system, and the efficiency of its individual components should probably not be judged in isolation from the system as a whole.

It is also debatable whether libraries with such diverse organizational structures and of possibly widely varying qualities should be lumped together and considered as representatives of the same species. However, to the extent that this is valid, and to the extent that comparisons between States are meaningful, the results may be illuminating to the informed reader. It is perhaps notable that the marginal and average costs achieved by the Tasmanian system are far lower than those of the other States.

To the extent that the comparison of results for similar organizational structures in different States is meaningful, Tables 3.15 to 3.20 may also provide further information. Again, differences in the quality of both inputs and outputs should be kept in mind. For example there is a far higher frequency of qualified staff involved in rural libraries in Victoria than is found in rural systems in other States.[1]

Costs of Individual Library Activities.

6.8 A survey of a small number of public libraries in New South Wales and Victoria produced evidence that the average costs of carrying out the acquisition activity declined as the throughput of that activity (measured by the number of books added) increased. Similarly, evidence was found that the average cost of processing inter-library loans declines as the number of loans processed increases. There is some suggestive evidence that the average cost of end-processing declines as the throughput of that activity increases. This is at least prima facie evidence that rationalisation of certain operations into larger units is justified, quite apart from any improvement in quality of the service which is usually assumed to accompany such a step.

The average costs of cataloguing in the small sample of libraries studied appeared to decline at first but later rose as the throughput of this operation increased. The evaluation of cataloguing is an area where differences in the quality of the service may explain the apparently higher unit cost of large operations.

Evidence concerning the unit costs of performing other operations within this sample of public libraries was inconclusive with respect to the influence of size on costs.

1. Committee of Inquiry into Public Libraries, Public Libraries in Australia, Australian Government Publishing Service, Canberra, 1976, Tables 3.10 and 3.11.

Limitations and Qualifications of the Results

6.9 The results presented herein should be viewed in the light of the constraints imposed upon them by the methodologies employed. For example, constancy of marginal cost should not be taken literally; it is merely a necessary consequence of one of the simple models of cost behaviour applied to the data. Two of the commonly repeated caveats concerning regression techniques are relevant here also. Firstly, an observed close relationship between two variables does not necessarily imply causation. That is, it may not be possible to effect a change in the nominally dependent variable by simply changing the level of the nominally "explanatory" variables. Secondly, it may not be valid to extrapolate the behaviour of the variables studied beyond the ranges of magnitude for which the relationships were determined. For example, although falling average costs were often observed, it can not be confidently predicted that the average costs will not start to rise at levels of operation which may be reached in the future.

6.10 This study does not attempt to allow, in any quantitative way, for the wide variations in the quality of both inputs and services which must be associated with the systems studied. Nevertheless, it is felt that quantitative indicators of many qualitative factors do exist, and some allowance for these could be attempted in future research.

6.11 The data on which this study was based is suspected to contain substantial errors, but it is not likely that they have affected the broad implications of the results. Informed readers must already be aware of inaccuracies in published data. Furthermore, the information collected by the A.B.S. questionnaire instigated by the Committee was marked by significant gaps, further reporting errors, and variation of definitions assumed by respondents in different States. The research team was hampered at times by logistical inefficiencies in the collection and collation of these data, and here records a strong plea that the total data base accumulated be tabulated, published, maintained by annual updating, and preferably extended in certain areas.

6.12 The authors readily acknowledge the inadequacies of the summary measures used in this report to quantify efficiency and level of library services. But in a field where there is a conspicuous lack both of explicit statements of objectives and of operational yardsticks to monitor the achievement of these objectives, they feel that this study is a useful first step in the development of *a* relevant measuring rod. They do not suggest that the measures described herein are the best, or the only ones relevant. On the contrary, it will be worthwhile if this report elicits greater efforts to specify explicitly improved measures of efficiency and performance which are also operationally feasible.

Avenues for Further Research

6.13 Many avenues of potentially fruitful research have been revealed by this study.

(a) Extension of the analysis of cost functions, including a refinement of the definitions of both outputs (or services) and inputs seems indicated. This will require the collection of special purpose statistics.

(b) Extension of multivariate relationships amongst factors of interest to library managers to all States would be illuminating.

(c) The technique of benefit-cost analysis is a potentially very useful contribution

to the evaluation of a wide range of library policies. This again requires the collection of special purpose statistics.

(d) The investigation of the costs of individual library activities indicates several areas where research of specific situations might be fruitful:

(i) the number of libraries studied should be extended so as to allow separate samples to be investigated for each organizational type. This would allow comparisons to be made with the evidence of the relationship between overall library costs and circulation.

(ii) It may be argued that the unit costs of circulation are more likely to be a function of the size of the individual service point rather than a function of the size of the library system as a whole. This means that further analysis of circulation costs is warranted with data recorded on the basis of the service point as the unit of observation.

(iii) A study of the varied experience of cost reduction by libraries instigating computer methods in certain activities.

(iv) More detailed study of costs of inter-library and inter-branch loans, or in general, the transfer of material, in the light of possible regionalisation. Factors necessary for efficient I.L.L. operations.

(v) Benefit-cost analysis of cataloguing operation in libraries of different sizes and different organizational types.

(vi) The effects of special programmes on the use of library services. For example, the effect on circulation, or aspects of it, of "marketing" operations.

(vii) The costs and outputs of libraries during hours other than 9 to 5, Monday to Friday.

(viii) Sample surveys of non-user information.

Some Policy Implications

6.14 Evidence relating to economies of size suggests that additional funds for the expansion of library services would be productive. This holds regardless of the organizational system, i.e. regional, independent (free or subscription).

Considerable flexibility remains in the choice of the type of organization of public library systems. That is, "who does what, and where?". When individual operations are considered, evidence suggests that large, perhaps centralised processes of acquisition and end-processing would achieve lower per unit costs than would individual, smaller library units. Substantial cost savings might also be reaped by increasing the scale of inter-library loan operations in selected libraries. This is an area therefore, where regionalisation may increase efficiency.

The study showed that average cataloguing costs increase for large libraries, but it is stressed that in this area also, benefits of cataloguing in libraries of different sizes have been ignored, and may well outweigh the higher costs incurred by large libraries.

Apart from the above conclusions, evidence was found, on an aspect of internal management, that specialisation of tasks was associated with lower unit costs in some areas. This implies, for example, that there is an argument for making individual libraries large enough to allow particular people to spend a high proportion of their time on single tasks, and to have fewer staff involved in that task.

Appendix A
Limitations of Data

I. Data Sources

Queensland: Public Libraries in Queensland, Statistical Bulletin 1974/75.
New South Wales: Report of the Library Council of New South Wales 1974/75.
Victoria: Australian Bureau of Statistics Survey 1975.
Tasmania: Australian Bureau of Statistics Survey 1975.
South Australia: Australian Bureau of Statistics Survey 1975.
West Australia: Australian Bureau of Statistics Survey 1975.
} Questionnaires completed by local government authorities for the C.I.P.L.

II. Limitations of Data

A. Queensland

No individual figures were available for individual service points in the Brisbane metropolitan library system which is conducted by the Brisbane City Council as a centralized operation. Since only overall figures were available it was not possible to incorporate an analysis of this system in the cost function only.

Current operating costs could be calculated for this State but due to the unavailability of such data for most other States it was decided for comparative purposes to use total expenditure as well in the subsequent analyses.

The classification of the data was such that no distinction was made between country and urban independent libraries—they are grouped together as free libraries. This difference should be kept in mind when making comparisons with States where such a distinction was made.

B. New South Wales

No current operating costs could be calculated from the data available.

There were no distinctions made between metropolitan and urban libraries as described in the data source.

The joint library systems that were based totally or partially in the metropolitan area of Sydney were excluded from the metropolitan analysis and included with country joint library systems.

C. Victoria

Insufficient information was available to calculate current operating costs.

The data were classified into urban and rural groupings.

D. Tasmania

The data from the ABS survey were not classified into urban and rural. Only two regional groupings were listed.

Our discussion with officials of the State Library of Tasmania leads us to entertain doubts concerning the validity of the expenditure figures quoted which appear to be understated. This is a likely reason for the very low marginal cost for Tasmania.

E. South Australia

The data were very limited with only fourteen libraries providing figures for the ABS questionnaire. As a result classification by type of system was possible.

F. Western Australia

The data were presented in an urban/rural format with no regional groupings given.

Appendix B

Means and standard deviations of cost and output data

System	Expenditure Mean	Circulation Mean	Expenditure Standard Deviation	Circulation Standard Deviation	Mean Cost/ Circulation
Central Highlands n = 5	7250.6000	13445.6000	4242.5343	7991.3632	.53925
Central-Western n = 8	4898.6250	8494.0000	2951.3621	6319.0303	.57671
North-Western n = 8	10294.7500	18482.1250	20675.9188	30290.0711	.55701
South-Western n = 5	8166.4000	10122.4000	6896.5118	8440.8446	.80676
Combined regions n = 26	7639.6923	12832.6539	11720.6131	17534.9916	.59533
Inter-regional n = 4	90565.2500	83322.2500	36040.3219	43746.0858	1.08693
Free n = 47	26118.5319	72143,3617	42093.6792	116699.1200	.36204
Subscriptions n = 56	12222.8000	65903.6000	4416.0989	74238.1182	.18546
Overall	24981.1786	72384.7321	43154.4464	109123.5440	.34512

Appendix C

Questionnaire

FORM A

1. Expenditure on books and related materials

	1971/72	1972/73	1973/74	1974/75
Adult: fiction				
non fiction				
Children:				

2. Capital expenditure.[1]

	1971/72	1972/73	1973/74	1974/75
Buildings				
Equipment				

3. Cost of library operations in 1974/75.

Operation	Materials	Other Direct Costs
1. Acquisition[2]		
2. Cataloguing		
3. End-processing		
4. Circulation[3]		
5. Inter-library loans		
6. Reference[4]		
7. Photocopying[5]		
8. Special programmes[6]		
9. Administration		

(Staff salary costs will be entered on form B).

Notes

1. Enter the total capital costs of the items (excluding interest repayments) in the first year the items became available, i.e. disregard the time profile of actual cash repayments.
2. Excluding the costs of the books.
3. Including borrower's register.
4. Including readers' adviser.
5. By and for users rather than for internal use.
6. Including programmes for the housebound, special programmes for children, special publicity exercises, etc.

4. We are trying to gain some idea of the proportion of the library's resources which are in use at any time, on average for a year. One approach is to estimate the proportion of the bookstock which is in circulation. If you do not keep records which directly give this figure, perhaps the following variable would lead to an approximate figure.

Total circulation for the year	:
Number of days open in the year	:
Length of loan period	:
Approximate percentage of books which are returned on the due date	:
Total revenue from fines	:
Fine per day late	:

5. We are also trying to draw a distinction between those who actually or potentially use the library service, and those who live in the municipalities nominally associated with the library service. This distinction recognizes that people may find it more convenient to use the libraries of neighbouring municipalities, or may live too far from any library for the use of a library to be feasible. Geographical separation of home from work is also relevant here. With these factors in mind, could you make some guess (however rough) about the following.
   5.1 Estimated population of the "catchment" area.
   5.2 Estimated proportion of actual users who reside outside the municipalities supporting your service.
   5.3 Estimated proportion of the catchment population who reside outside the municipalities supporting your service.
   State any significant changes in 5.1 to 5.3 since 1971.

FORM B

To be completed by all library staff

Time spent on specific library operations.

Operation	Proportion of time spent on each operation
1. Acquisition	
2. Cataloguing	
3. End processing	
4. Circulation[1]	
5. Inter-library loans	
6. Reference[2]	
7. Photocopying[3]	
8. Special programmes[4]	
9. Administration	
TOTAL	100%

Your salary

Notes:

1. Include borrower's register.
2. Include readers' adviser.
3. By and for users rather than for internal use.
4. Including programmes for the housebound, special children's programmes, special publicity exercises.

Appendix D

Appendix D.1. Direct Labour Costs

Library	Book-stock	Acquisition	%	Cataloguing	%	End Processing	%	Circulation	%	Inter-library loans	%	Reference	%	Photo-copying	%	Special Programmes	%	Administration	%	Total Labour
1	291,877	18,932	4.62	90,071	22.00	50,041	12.22	124,888	30.50	5,147	1.26	53,314	13.02	2,217	0.54	8,770	2.14	56,074	13.69	409,454
2	192,558	20,671	7.40	13,075	4.68	39,487	14.14	118,713	42.51	7,472	2.68	30,349	10.87	1,012	0.36	20,025	7.17	28,454	10.19	279,258
3	189,261	27,800	10.71	20,382	7.85	20,514	7.90	62,289	24.00	3,674	1.42	43,553	16.78	6,193	2.39	19,941	7.68	55,194	21.27	259,540
4	181,338	28,439	6.32	39,913	8.87	59,187	13.15	168,477	37.43	7,487	1.66	59,313	13.18	8,292	1.84	18,363	4.08	60,583	13.46	450,054
5	136,057	7,373	5.60	19,456	14.78	16,311	12.39	24,885	18.91	1,021	0.78	31,133	23.65	1,193	0.91	3,546	2.69	26,701	20.29	131,619
6	133,081	18,471	5.28	51,078	14.60	42,323	12.09	122,462	35.00	7,233	2.07	47,514	13.58	2,431	0.69	26,912	7.69	31,509	9.00	349,933
7	75,157	3,9601	3.20	7,240	5.85	26,100	21.09	47,606	38.47	3,875	3.13	15,046	12.16	1,953	1.58	10,423	8.42	7,560	6.11	123,763
8	75,053	3,937	4.20	7,176	7.65	12,335	13.15	41,986	44.77	3,714	3.96	7,887	8.41	1,007	1.07	2,805	2.99	12,943	13.80	93,790
9	74,039	12,408	17.52	5,095	7.19	10,625	15.00	14,473	23.26	2,909	4.11	5,574	7.87	1,722	2.43	7,504	10.58	8,514	12.08	70,814
10	59,496	21,867	12.64	42,752	24.72	688	0.40	49,794	28.79	946	0.55	25,665	14.84	834	0.48	10,627	6.14	19,785	11.44	172,958
11	50,438	8,060	10.02	6,396	7.95	4,784	5.95	31,122	38.69	3,120	3.88	7,773	9.66	780	0.97	7,176	8.92	1,234	13.96	80,445
12	36,000	6,227	15.14	3,945	9.57	1,432	3.48	16,642	40.47	534	1.30	5,934	14.43	1,120	2.72	2,458	5.98	2,830	6.88	41,122
13	35,999	2,724	6.62	5,589	13.58	3,798	9.23	18,546	45.05	876	2.13	5,059	12.29	1,252	3.04	1,109	2.69	2,217	5.38	41,170
14	32,935	8,645	7.57	13,796	12.08	4,140	3.63	44,347	38.84	3,634	3.18	12,667	11.09	457	0.40	3,370	2.95	23,133	20.26	114,191
15	32,000	6,092	10.90	4,680	8.38	21,604	38.66	15,535	27.80	445	0.80	3,781	6.77	-	-	155	0.28	3,857	6.42	55,879
16	30,308	2,743	4.49	1,090	1.79	9,771	5.01	21,532	35.27	1,715	2.81	14,996	24.56	-	-	2,064	3.35	7,136	11.69	61,047
Total		198,349	7.25	331,734	12.13	323,140	11.81	916,499	33.51	76,460	2.80	355,698	13.01	30,463	1.11	145,248	5.31	357,454	13.07	2,735,037
Labour as a % of Total Direct Cost		92.5		90.24		78.12		90.21		91.29		95.10		47.43		83.31		44.23		77.79

Percentages are of total labour costs for each library.

Appendix D.2. Direct Total Costs

Library	Book-stock	Acquisition	%	Cataloguing	%	End Processing	%	Circulation	%	Inter-library loans	%	Reference	%	Photo-copying	%	Special Programmes	%	Administration	%	Total costs
1	291,877	19,052	3.64	90,944	17.39	56,554	10.81	127,348	24.35	6,710	1.28	53,676	10.26	7,417	1.43	8,850	1.69	152,372	29.14	522,923
2	192,558	22,171	7.36	14,825	4.92	51,487	17.10	121,213	40.26	8,022	2.66	31,349	10.41	1,012	0.34	21,525	7.15	29,504	9.80	301,108
3	189,261	34,733	10.14	27,315	7.97	30,558	8.92	86,532	24.07	3,874	1.13	43,553	12.71	8,645	2.52	22,901	6.68	88,597	25.86	342,630
4	181,338	28,839	3.89	41,913	5.66	77,187	10.42	183,077	24.71	8,187	1.10	59,713	8.06	14,292	1.93	20,613	2.78	307,183	41.45	741,004
5	136,057	7,773	5.06	20,256	13.17	18,811	12.24	32,385	21.07	1,621	1.05	34,483	22.43	5,943	3.86	4,796	3.12	27,701	18.03	153,769
6	133,081	23,107	4.93	66,406	14.12	61,180	13.01	160,601	34.16	9,237	1.96	59,789	12.72	9,348	1.99	37,951	8.07	42,496	9.04	470,178
7	75,157	3,960	2.84	7,240	5.20	26,672	19.16	49,602	35.63	4,125	2.96	15,046	10.81	3,253	2.34	16,773	12.05	12,560	9.02	139,231
8	75,053	4,537	4.38	7,726	7.45	12,935	12.47	43,486	41.93	3,789	3.65	8,037	7.75	1,427	1.38	3,325	3.21	18,438	17.78	103,700
9	74,039	12,457	14.42	5,135	5.94	11,125	12.88	19,123	22.13	2,964	3.43	5,589	6.47	2,172	2.51	7,629	8.82	20,214	23.40	86,408
10	59,496	22,367	10.76	48,952	23.54	12,688	6.10	53,094	25.53	1,106	0.53	25,865	12.44	1,314	0.63	11,227	5.40	31,335	15.07	207,948
11	50,438	8,170	8.19	6,634	6.65	6,270	6.28	32,721	32.79	3,314	3.32	7,773	7.79	2,477	2.48	7,240	7.26	25,176	25.23	99,775
12	36,000	6,327	12.61	4,305	8.58	3,532	7.04	17,242	34.36	1,184	2.36	6,434	12.82	1,620	3.23	3,958	7.89	5,580	11.12	50,182
13	35,999	3,102	6.87	5,646	12.51	4,416	9.78	19,116	42.34	1,105	2.45	5,105	11.31	1,942	4.30	1,297	2.87	3,417	7.57	45,146
14	32,935	8,788	7.00	13,927	11.09	5,653	4.50	45,066	35.88	3,656	2.91	12,680	10.10	3,371	2.68	3,972	3.16	28,493	22.68	125,606
15	32,000	6,201	10.44	4,767	8.03	23,777	40.03	16,511	27.80	464	0.78	3,781	6.37	-	-	199	0.34	3,701	6.23	59,401
16	30,308	2,783	4.15	1,610	2.40	10,821	16.13	21,682	32.32	1,735	2.59	14,996	22.35	-	-	2,084	3.11	11,376	16.96	67,087
Total		214,430	6.10	367,601	10.45	413,666	11.76	1,015,923	28.89	83,751	2.38	374,009	10.64	64,233	1.83	174,340	4.96	808,143	22.98	3,516,096

Appendix D.3. Direct Material and Other Direct Costs

Library	Book-stock	Acquisition	%	Cataloguing	%	End Processing	%	Circulation	%	Inter-library loans	%	Reference	%	Photo-copying	%	Special Programmes	%	Administration	%	Total costs excl. labour
1	291,877	120	0.11	873	0.77	6,513	5.74	2,460	2.17	1,563	1.38	362	0.32	5,200	4.58	80	0.07	96,298	84.87	113,469
2	192,558	1,500	6.86	1,750	8.01	12,000	54.92	2,500	11.44	550	2.52	1,000	4.58	-	-	1,500	6.86	1,050	4.81	21,850
3	189,261	6,933	8.34	6,933	8.34	10,044	12.09	20,165	24.27	200	0.24	-	-	2,452	2.95	2,960	3.56	33,403	40.20	83,090
4	181,338	400	0.14	2,000	0.69	18,000	6.19	14,600	5.02	700	0.24	400	0.14	6,000	2.06	2,250	0.77	246,600	84.76	290,950
5	136,057	400	1.81	800	3.61	2,500	11.29	7,500	33.86	600	2.71	3,350	15.12	4,750	21.44	1,250	5.64	1,000	4.51	22,150
6	133,081	4,699	3.91	15,328	12.75	18,857	15.68	38,139	31.72	2,004	1.67	12,265	10.21	6,917	5.75	11,039	9.18	10,987	9.14	120,245
7	75,157	-	-	-	-	572	3.70	1,996	12.90	250	1.62	-	-	1,300	8.40	6,350	41.05	5,000	32.32	15,468
8	75,053	600	6.05	550	5.55	600	6.05	1,500	15.14	75	0.76	150	1.51	420	4.24	520	5.25	5,495	55.45	9,910
9	74,039	59	0.38	40	0.26	500	3.21	2,650	16.99	55	0.35	15	0.10	450	2.89	125	0.80	11,700	75.03	15,594
10	59,496	500	1.43	6,200	17.72	12,000	34.30	3,300	9.43	160	0.46	200	0.57	480	1.38	600	1.71	11,550	33.01	34,990
11	50,438	110	0.79	238	1.23	1,486	7.69	1,599	8.27	194	1.00	-	-	1,697	8.78	64	0.33	13,942	72.13	19,330
12	36,000	100	1.10	360	3.97	2,100	23.18	600	6.62	650	7.17	500	5.52	500	5.52	1,500	16.56	2,750	30.35	9,060
13	35,999	378	9.51	57	1.43	618	15.54	570	14.34	229	5.76	46	1.16	690	17.35	188	4.76	1,200	30.18	3,976
14	32,935	143	1.25	131	1.15	1,513	13.25	719	6.30	22	0.19	13	0.11	2,914	25.53	600	5.26	5,360	46.96	11,415
15	32,000	109	3.09	87	2.47	2,173	61.70	976	27.71	19	0.54	-	-	-	-	44	1.25	114	3.24	3,522
16	30,308	40	0.66	520	8.61	1,050	17.38	150	2.48	20	0.33	-	-	-	-	20	0.33	4,240	70.20	6,040
Total		16,091	2.06	35,867	4.59	90,526	11.59	99,424	12.73	7,291	0.93	18,311	2.34	33,770	4.32	29,090	3.72	450,689	47.70	781,059

Percentages are of total material and other direct costs for each library.

Appendix D.4. Average Costs (Labour)

Library	Bookstock	1 Acquisition	2 Cataloguing	3 End. Proc.	4 Cir. Cost	5 Ill. Cost	6 Special Programmes	7 Reference	8 Photcopying	9(a) Admin.	9(b) Admin.
1	291,877	.71	3.39	1.88	.11	4.21	.02	.32	.01	.19	.05
2	192,558	1.57	.99	3.00	.13	4.73	.08	.41	.01	.15	.03
3	189,261	.77	.57	.57	.09	7.58	.07	.58	.08	.29	.08
4	181,338	1.38	1.94	2.88	.15	2.87	.07	.80	.11	.33	.05
5	136,057	.55	1.46	1.23	.05	.91	.03	.39	.02	.20	.06
6	133,081[1]	.96	2.65	2.20	.16		.13	.98	.05	.24	.04
7	75,157[1]	.68	1.25	4.49	.09	7.08	.16	.59	.08	.10	.03
8	75,053	.89	1.62	2.79	.13	25.61	.08	.25	.03	.17	.04
9	74,039	3.99	1.64	3.42	.10	15.31	.21	.19	.06	.11	.05
10	59,496	2.45	4.79	.08	.16	14.33	.13	1.41	.05	.33	.06
11	50,438				.18		.08	.38	.04	.22	.07
12	36,000[2]				.09		.04			.08	.02
13	35,999	.66	1.36	.92	.09	1.98	.05	.38	.09	.06	.01
14	32,035	2.85	4.55	1.37	.26	9.59	.11	.94	.03	.70	.14
15	32,000				.06		.01			.11	.02
16	30,308[1]	1.01	.40	3.60	.09	7.39	.08	1.35	0.00	.24	.03

Notes: 1. Figure for 1973–74.
2. Estimate. Figure for 1971–72 was 34,269.

Appendix D.5. Average Costs (All Direct Costs)

Library	Bookstock	1 Acquisition	2 Cataloguing	3 End. Proc.	4 Cir. Cost	5 Ill. Cost	6 Special Programmes	7 Reference	8 Photcopying	9(a) Admin.	9(b) Admin.
1	291,877	.72	3.42	[illegible]	.11	5.49	.02	.32	.04	.52	.13
2	192,558	1.69	1.13	[illegible]	.14	5.08	.09	.42	.01	.15	.03
3	189,261	.96	.76	.85	.12	7.94	.08	.58	.11	.47	.13
4	181,338	1.40	2.04	3.76	.16	3.13	.25	.80	.19	1.69	.27
5	136,057	.58	1.52	1.41	.07	1.45	.04	.43	.07	.20	.06
6	133,081[1]	1.20	3.42	3.18	.21		.19	1.23	.19	.32	.06
7	75,157[1]	.68	1.25	4.59	.10	7.54	.26	.59	.13	.17	.02
8	75,053	1.03	1.75	2.93	.13	26.13	.10	.26	.05	.25	.06
9	74,039	4.00	1.65	3.58	.12	15.60	.21	.19	.08	.27	.12
10	59,496	2.50	5.48	1.42	.17	16.76	.14	1.42	.07	.53	.10
11	50,438				.19		.09	.38	.12	.50	.15
12	36,000[2]				.09		.07			.16	.03
13	35,999	.76	1.37	1.00	.09	2.50	.05	.38	.15	.09	.02
14	32,935	2.90	4.59	1.86	.26	9.65	.13	.94	.25	.87	.17
15	32,000				.07		.01			.12	.02
16	30,308[1]	1.03	.59	3.99	.09	7.48	.08	1.35	0.00	.38	.05

Notes: 1. Figure for 1973–74.
2. Estimate Figure for 1971–72 was 34,269.

Appendix D.6. Comparative Structures

Library	Bookstock	Circulation	Circulation / Bookstock	Additions	Additions / Bookstock (%)	Expenditure on Books	Bookcost/ Book
1	291,877	1,176,139	4.03	26,603	9.1	76,215	2.86
2	192,558	888,281	4.61	13,148	6.8	59,981	4.56
3	189,261	708,070	3.74	36,000	19.0	96,000	2.67
4	181,338	1,121,000	6.18	20,544	11.3	103,049	5.02
5	136,057	461,730	3.39	13,307	9.8	54,248	4.08
6	133,081[1]	766,060	5.32	19,245[1]	14.5	92,188	4.79
7	75,157[1]	502,914	6.69	5,815	7.7	21,194	3.64
8	75,053	331,467	4.42	4,419	5.9	18,000	4.07
9	74,039	162,349	2.19	3,110	4.1	8,418	2.71
10	59,496	306,364	5.15	8,929	15.0	45,000	5.04[4]
11	50,438	169,471	3.36				
12	36,000[2]	185,196	5.14		11.4		
13	35,999	215,815	6.00	4,110	9.2	17,200	4.18
14	32,935	170,577[1]	5.18	3,032[1]		14,466[3]	4.76
15	32,000	245,612	7.68				
16	30,308[1]	240,686[1]	7.94	2,711	8.9	2,892	1.07[5]

Notes: 1. 1973–74.
2. Estimated (1972–73 was 34,269)
3. Includes expenditure on audio-visual, periodicals, etc.
4. For 1973–74, 17,400 books cost an average of $2.13.
5. For 1972–73, 3,998 books cost an average of $4.13.

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